

Supplemental material

Parental occupational exposure to benzene and the risk of childhood cancer: a census-based cohort study

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**Figure S1: Directed acyclic graph (DAG) of known and hypothesized causal associations
(Potentially confounding variables in italics)**

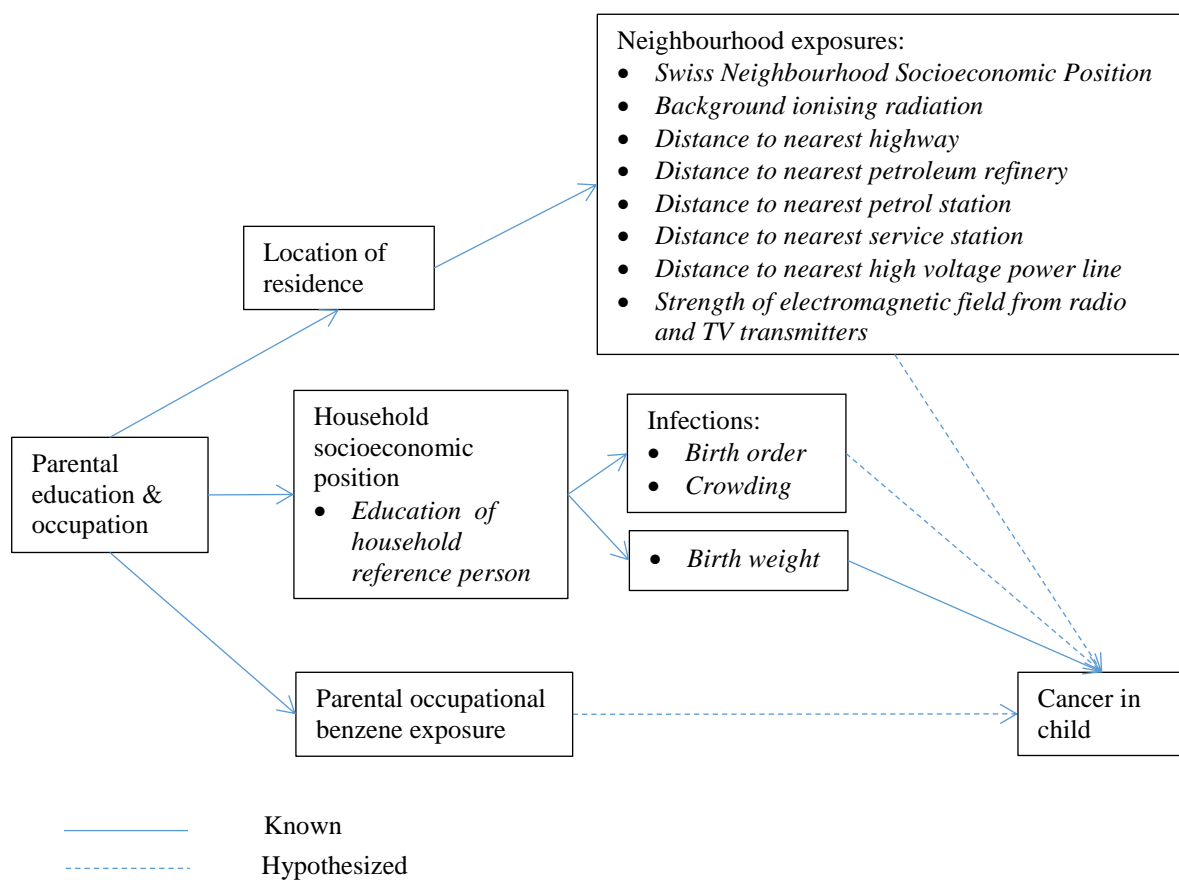


Table S1: Description of time to event data for children included in main analyses according to age at entry and census year

Subgroup		Number children	Total person years FU	Median FU	Number of cases			CNS tumours
				time [years]	Any cancer	Leukaemia	Lymphoma	
Maternal exposure	Entire cohort	1,138,826	8,985,970	7.9	1004	285	186	227
Included in census	1990 only ^a	533,758	2,741,236	5.1	257	71	57	50
	1990 and 2000 ^b	308,108	4,022,947	13.1	469	130	90	97
	2000 only ^c	296,960	2,221,786	7.5	278	84	39	80
Age at entry	0-4 years	407,021	4,711,945	11.6	630	190	104	144
	5-9 years	410,524	3,311,614	8.1	316	82	68	74
	10-15 years	321,281	962,411	3.0	58	13	14	9
Paternal exposure	Entire cohort	1,664,801	13,204,386	7.9	1479	438	281	339
Included in census	1990 only ^a	694,524	3,618,640	5.2	371	109	82	78
	1990 and 2000 ^b	410,831	5,355,541	13.0	596	169	114	118
	2000 only ^c	559,446	4,230,205	7.6	512	160	85	143
Age at entry	0-4 years	637,619	7,023,098	11.0	898	283	138	205
	5-9 years	614,591	4,933,947	8.0	486	126	120	118
	10-15 years	412,591	1,247,341	3.0	95	29	23	16

Abbreviations: FU follow-up, CNS central nervous system

^a Entry into cohort at census 1990, right censored before census 2000

^b Entry into cohort at census 1990, still in follow-up at census 2000

^c Entry into cohort at census 2000

Table S2: Most common^a occupations among mothers exposed to benzene at their work place

ISCO-88 code	Description	Mean exposure ^b	Mothers	
			N	% ^c
9132	Helpers, and cleaners in offices, hotels, and other establishments	0.10	29,28	25.7
			7	2
3111	Chemical and physical science technicians	2.00	6,969	6.12
3471	Decorators and commercial designers	0.88	4,659	4.09
7311	Precision-instrument makers and repairers	0.50	2,615	2.30
3211	Life science technicians	2.00	2,209	1.94
8280	Assemblers	0.80	1,997	1.75
8290	Other machine operators and assemblers	0.20	1,931	1.70
8264	Bleaching-, dyeing- and cleaning-machine operators	0.10	1,732	1.52
8211	Machine tool operators	0.88	1,204	1.06
9133	Hand-laundrers and pressers	0.10	1,096	0.96
7341	Compositors, typesetters and related workers	5.00	1,065	0.94
9322	Hand packers and other manufacturing labourers	1.25	1,018	0.89
7241	Electrical mechanics and fitters	0.50	895	0.79
8251	Printing-machine operators	2.50	819	0.72
7213	Sheet-metal workers	2.50	668	0.59
2452	Sculptors, painters and related artists	1.25	553	0.49
7442	Shoe-makers and related workers	5.00	545	0.48
7313	Jewellery and precious-metal workers	0.50	527	0.46
7345	Bookbinders and related workers	5.00	526	0.46
7242	Electronics fitters	0.50	499	0.44
7141	Painters and related workers	12.50	458	0.40
7200	Metal, machinery and related trades workers	1.00	402	0.35
2113	Chemists	1.25	366	0.32
7343	Printing engravers and etchers	2.50	354	0.31
8200	Machine operators and assemblers	0.88	339	0.30
2211	Biologist, botanist, zoologist	0.50	337	0.30
7324	Glass, ceramics and related decorative painters	0.50	299	0.26
8253	Paper-products machine operators	0.31	254	0.22
7430	Textile, garment and related trades workers	2.50	250	0.22
7422	Cabinet makers and related workers	1.25	236	0.21
7222	Tool-makers and related workers	1.00	197	0.17

3119	Physical and engineering science technicians	1.00	190	0.17
7231	Motor vehicle mechanics and fitters	1.00	186	0.16
8150	Chemical-processing-plant operators	1.50	171	0.15
7346	Silk-screen, block and textile printers	2.00	163	0.14
7245	Electrical line installers, repairers and cable jointers	0.50	139	0.12
8231	Rubber-products machine operators	1.25	139	0.12
8232	Plastic-products machine operators	1.25	129	0.11

^a Occupations held by at least 100 mothers

^b Mean exposure among mothers in respective occupational categories. Exposure was assessed using a job exposure matrix for benzene (BEN-JEM) for the occupation held at the time of the first census (1990 or 2000) the child was reported in. Values represent the product of the proportion of workers exposed and the level of exposure [ppm].

^c Relative frequency among all mothers included in the main analysis [‰].

Table S3: Most common^a occupations among fathers exposed to benzene at their work place

ISCO-88 code	Description	Mean exposure ^b	Fathers	
			N	% ^c
7200	Metal, machinery and related trades workers	1.00	24,370	14.64
7422	Cabinet makers and related workers	1.25	18,731	11.25
7241	Electrical mechanics and fitters	0.50	18,192	10.93
7222	Tool-makers and related workers	1.00	16,297	9.79
7136	Plumbers and pipe fitters	1.25	14,201	8.53
7231	Motor vehicle mechanics and fitters	1.00	14,087	8.46
8280	Assemblers	0.80	12,908	7.75
7141	Painters and related workers	12.50	12,361	7.42
7124	Carpenters and joiners	1.25	8,201	4.93
7311	Precision-instrument makers and repairers	0.50	5,450	3.27
8251	Printing-machine operators	2.50	5,231	3.14
7129	Building frame and related trades workers not elsewhere classified	0.62	5,160	3.10
3471	Decorators and commercial designers	0.88	5,134	3.08
7132	Floor layers, tile setters	6.25	5,078	3.05
7223	Machine-tool setters and setter-operators	1.00	4,871	2.93
8211	Machine tool operators	0.88	4,777	2.87
3111	Chemical and physical science technicians	2.00	4,122	2.48
7242	Electronics fitters	0.50	4,028	2.42
3119	Physical and engineering science technicians	1.00	3,907	2.35
7213	Sheet-metal workers	2.50	3,823	2.30
2113	Chemists	1.25	3,364	2.02
7142	Varnishers and related painters	12.50	2,649	1.59
7341	Compositors, typesetters and related workers	5.00	2,553	1.53
7131	Roofers	6.25	2,221	1.33
7233	Agricultural- or industrial-machinery mechanics and fitters	1.00	2,192	1.32
9132	Helpers, and cleaners in offices, hotels, and other establishments	0.10	2,162	1.30
8200	Machine operators and assemblers	0.88	2,146	1.29
3115	Mechanical- engineering technicians	2.50	2,012	1.21
7230	Machinery mechanics and fitters	1.00	1,899	1.14
8150	Chemical-processing-plant operators	1.50	1,833	1.10
2452	Sculptors, painters and related artists	1.25	1,432	0.86
7245	Electrical line installers, repairers and cable jointers	0.50	1,338	0.80

7442	Shoe-makers and related workers	5.00	1,320	0.79
7313	Jewellery and precious-metal workers	0.50	1,110	0.67
8223	Metal finishing-, plating- and coating-machine operators	1.00	952	0.57
7345	Bookbinders and related workers	5.00	917	0.55
7221	Blacksmiths, hammer-smiths and forging-press workers	1.00	853	0.51
8264	Bleaching-, dyeing- and cleaning-machine operators	0.10	853	0.51
2211	Biologist, botanist, zoologist	0.50	819	0.49
7343	Printing engravers and etchers	2.50	813	0.49
7232	Aircraft engine mechanics and fitters	0.20	771	0.46
8281	Mechanical-machinery assemblers	1.00	739	0.44
7224	Metal wheel-grinders, polishers and tool sharpeners	1.00	704	0.42
8232	Plastic-products machine operators	1.25	605	0.36
8290	Other machine operators and assemblers	0.20	577	0.35
7437	Upholsterers and related workers	2.50	559	0.34
8155	Petroleum- and natural-gas-refining-plant operators	11.04	530	0.32
7312	Musical instrument makers and tuners	0.50	508	0.31
8253	Paper-products machine operators	0.31	507	0.30
7211	Metal moulders and core makers	6.25	388	0.23
7346	Silk-screen, block and textile printers	2.00	386	0.23
7331	Handicraft workers in wood and related materials	2.00	366	0.22
2146	Chemical engineers	1.25	351	0.21
9322	Hand packers and other manufacturing labourers	1.25	346	0.21
3116	Chemical engineering technicians	2.00	328	0.20
3211	Life science technicians	2.00	326	0.20
7430	Textile, garment and related trades workers	2.50	290	0.17
9142	Vehicle, window, and related cleaners	0.10	223	0.13
8240	Wood-products machine operators	1.25	176	0.11
8131	Glass, ceramics, kiln and related workers	0.20	168	0.10
8231	Rubber-products machine operators	1.25	153	0.09
7441	Pelt dresser, tanners, and fellmongers	2.50	150	0.09
7421	Wood treaters	6.25	117	0.07
7324	Glass, ceramics and related decorative painters	0.50	116	0.07

^a Occupations held by at least 100 fathers

^b Mean exposure among fathers in respective occupational categories. Exposure was assessed using a job exposure matrix for benzene (BEN-JEM) for the occupation held at the time of the first census

(1990 or 2000) the child was reported in. Values represent the product of the proportion of workers exposed and the level of exposure [ppm].

^c Relative frequency among all fathers included in the main analysis [%].

Table S4: Association between parental occupational exposure to benzene and childhood cancer using exposure levels 10 years before census

Outcome	Exposure category	Cases ^a	IR per 100,000 PY	Minimally adjusted model ^b HR (95% CI)	Partially adjusted model ^c HR (95% CI)	Fully adjusted model ^d HR (95% CI)
Maternal exposure^e						
Any Cancer	none	933	11.23	1.00	1.00	1.00
	>0-2	43	10.50	0.95 (0.70, 1.29)	0.96 (0.70, 1.32)	0.95 (0.65, 1.37)
	>2	28	10.33	0.95 (0.65, 1.38)	0.96 (0.66, 1.39)	0.95 (0.61, 1.49)
Leukaemia	none	260	3.13	1.00	1.00	1.00
	>0-2	14	3.42	1.10 (0.64, 1.89)	1.08 (0.62, 1.88)	1.19 (0.64, 2.23)
	>2	11	4.06	1.36 (0.74, 2.50)	1.37 (0.75, 2.51)	1.76 (0.93, 3.34)
ALL	none	203	2.44	1.00	1.00	1.00
	>0-2	12	2.93	1.21 (0.67, 2.17)	1.22 (0.67, 2.22)	1.39 (0.72, 2.71)
	>2	9	3.32	1.45 (0.74, 2.84)	1.46 (0.74, 2.86)	1.98 (1.00, 3.90)
AML	none	44	0.53	1.00	1.00	1.00
	>0-2	2	0.49	0.94 (0.22-3.90)	0.77 (0.18-3.29)	0.57 (0.07-4.31)
	>2	1	0.37	0.68 (0.09-4.97)	0.68 (0.09-4.94)	0.00 (0.00-0.00)
Lymphoma	none	176	2.12	1.00	1.00	1.00
	>0-2	4	0.98	0.49 (0.18, 1.32)	0.53 (0.20, 1.46)	0.34 (0.08, 1.40)
	>2	6	2.21	1.01 (0.44, 2.28)	1.02 (0.45, 2.31)	0.71 (0.23, 2.25)
NHL	none	102	1.23	1.00	1.00	1.00
	>0-2	2	0.49	0.42 (0.10-1.70)	0.49 (0.12-2.01)	0.00 (0.00-0.00)
	>2	1	0.37	0.30 (0.04-2.13)	0.30 (0.04-2.13)	0.43 (0.06-3.09)
CNS tumours	none	214	2.58	1.00	1.00	1.00
	>0-2	10	2.44	0.90 (0.48, 1.70)	0.91 (0.48, 1.76)	0.95 (0.46, 1.98)
	>2	3	1.11	0.48 (0.15, 1.52)	0.48 (0.15, 1.51)	0.22 (0.03, 1.55)
Glioma	none	129	1.55	1.00	1.00	1.00
	>0-2	6	1.47	0.82 (0.36, 1.87)	0.83 (0.36, 1.93)	0.84 (0.33, 2.11)
	>2	1	0.37	0.29 (0.04, 2.10)	0.30 (0.04, 2.12)	0.00 (0.00, NA)
Paternal exposure^e						
Any Cancer	none	1181	11.31	1.00	1.00	1.00
	>0-2	77	10.70	0.87 (0.68, 1.10)	0.89 (0.70, 1.14)	0.94 (0.73, 1.21)
	>2-10	123	11.74	1.06 (0.88, 1.28)	1.07 (0.89, 1.30)	1.08 (0.87, 1.34)
	>10	98	9.86	0.90 (0.73, 1.11)	0.92 (0.74, 1.13)	0.93 (0.73, 1.19)
Leukaemia	none	359	3.44	1.00	1.00	1.00
	>0-2	19	2.64	0.66 (0.41, 1.06)	0.65 (0.40, 1.05)	0.72 (0.44, 1.17)

	>2-10	30	2.86	0.87 (0.60, 1.27)	0.86 (0.59, 1.26)	0.89 (0.58, 1.36)
	>10	30	3.02	0.94 (0.64, 1.37)	0.92 (0.63, 1.35)	0.93 (0.60, 1.43)
ALL	none	279	2.67	1.00	1.00	1.00
	>0-2	16	2.22	0.70 (0.41, 1.17)	0.71 (0.42, 1.20)	0.80 (0.47, 1.35)
	>2-10	24	2.29	0.90 (0.59, 1.38)	0.90 (0.59, 1.38)	0.99 (0.63, 1.57)
	>10	22	2.21	0.89 (0.57, 1.39)	0.89 (0.57, 1.39)	0.93 (0.57, 1.52)
AML	none	54	0.52	1.00	1.00	1.00
	>0-2	2	0.28	0.54 (0.13-2.31)	0.46 (0.11-1.97)	0.48 (0.11-2.09)
	>2-10	4	0.38	0.73 (0.26-2.04)	0.69 (0.25-1.92)	0.77 (0.23-2.53)
	>10	8	0.80	1.54 (0.72-3.29)	1.40 (0.65-3.00)	1.34 (0.51-3.51)
Lymphoma	none	217	2.08	1.00	1.00	1.00
	>0-2	14	1.95	0.97 (0.55, 1.72)	1.03 (0.58, 1.82)	1.14 (0.64, 2.03)
	>2-10	29	2.77	1.31 (0.89, 1.95)	1.35 (0.91, 2.01)	1.51 (0.96, 2.37)
	>10	21	2.11	1.00 (0.64, 1.58)	1.03 (0.65, 1.63)	1.13 (0.67, 1.92)
CNS tumours	none	278	2.66	1.00	1.00	1.00
	>0-2	22	3.06	0.89 (0.57, 1.41)	0.95 (0.60, 1.50)	1.05 (0.66, 1.66)
	>2-10	26	2.48	1.03 (0.69, 1.55)	1.09 (0.72, 1.64)	1.01 (0.63, 1.64)
	>10	13	1.31	0.56 (0.32, 0.98)	0.60 (0.34, 1.05)	0.66 (0.36, 1.23)
NHL	none	117	1.12	1.00	1.00	1.00
	>0-2	10	1.39	1.31 (0.66-2.61)	1.37 (0.68-2.76)	1.48 (0.73-3.00)
	>2-10	15	1.43	1.24 (0.72-2.14)	1.28 (0.74-2.23)	1.22 (0.64-2.31)
	>10	11	1.11	0.96 (0.51-1.79)	0.99 (0.52-1.86)	0.82 (0.37-1.81)
Glioma	none	155	1.48	1.00	1.00	1.00
	>0-2	15	2.08	1.05 (0.60, 1.82)	1.07 (0.61, 1.88)	1.15 (0.65, 2.03)
	>2-10	18	1.72	1.32 (0.80, 2.17)	1.35 (0.81, 2.23)	1.34 (0.76, 2.37)
	>10	7	0.70	0.55 (0.26, 1.19)	0.58 (0.27, 1.25)	0.65 (0.28, 1.51)

Abbreviations: ALL acute lymphoblastic leukaemia, AML acute myeloid leukaemia, CNS central nervous system, HR hazard ratio, IR Incidence ratio, PY person years, NA not available, NHL non-Hodgkin lymphoma

^a Number of cases in the minimally adjusted model. The total number of cases (any cancer) was 1004, 1000, and 773 in the minimally partial, partially and fully adjusted models respectively for maternal exposure and 1479, 1469, and 1196 respectively for paternal exposure.

^b Adjusted for sex, year of birth, and census (1990, 2000)

^c Additionally (to ^a) adjusted for education, crowding, neighbourhood socioeconomic position, background ionizing radiation, and electromagnetic fields from radio and TV transmitters, and distance to nearest highway, petroleum refinery, petrol station, and motor vehicle service station.

^d Additionally (to ^b) adjusted for birth order and birth weight (only includes children born in Switzerland and linked with birth registry data)

^e Product of the proportion of workers exposed and the level of exposure [ppm] (10 years prior to census) based on a job exposure matrix (BEN-JEM) and occupation at census.

Table S5: Sensitivity Analyses including children of mothers who were not economically active (exposure level zero assigned) – Association between parental occupational exposure to benzene and childhood cancer

Outcome	Exposure category	Cases^a	IR per 100,000 PY	Minimally adjusted model^b HR (95% CI)	Partially adjusted model^c HR (95% CI)	Fully adjusted model^d HR (95% CI)
Maternal exposure^e						
Any Cancer	none	1260	11.32	1.00	1.00	1.00
	>0	58	11.89	1.15 (0.88, 1.51)	1.17 (0.89, 1.54)	1.18 (0.86, 1.64)
Leukaemia	none	368	3.30	1.00	1.00	1.00
	>0	23	4.72	1.73 (1.12, 2.67)	1.74 (1.12, 2.69)	2.28 (1.42, 3.68)
ALL	none	292	2.62	1.00	1.00	1.00
	>0	19	3.90	1.88 (1.16, 3.04)	1.95 (1.20, 3.17)	2.63 (1.58, 4.36)
AML	none	56	0.50	1.00	1.00	1.00
	>0	3	0.62	1.18 (0.36-3.86)	1.04 (0.31-3.43)	0.65 (0.09-4.88)
Lymphoma	none	228	2.05	1.00	1.00	1.00
	>0	8	1.64	0.75 (0.37, 1.53)	0.76 (0.37, 1.56)	0.41 (0.13, 1.29)
NHL	none	123	1.10	1.00	1.00	1.00
	>0	3	0.62	0.51 (0.16-1.62)	0.53 (0.17-1.68)	0.26 (0.04-1.86)
CNS tumours	none	307	2.76	1.00	1.00	1.00
	>0	7	1.44	0.67 (0.31, 1.43)	0.68 (0.32, 1.45)	0.40 (0.13, 1.28)
Glioma	none	184	1.65	1.00	1.00	1.00
	>0	3	0.62	0.52 (0.16, 1.66)	0.55 (0.17, 1.74)	0.23 (0.03, 1.68)
Paternal exposure^e						
Any Cancer	none	1299	11.31	1.00	1.00	1.00
	>0-2	173	10.81	1.00 (0.85, 1.18)	1.02 (0.86, 1.20)	1.03 (0.85, 1.24)
	>2	41	12.13	1.12 (0.82, 1.54)	1.14 (0.83, 1.56)	1.21 (0.84, 1.72)
Leukaemia	none	388	3.38	1.00	1.00	1.00
	>0-2	49	3.06	0.97 (0.71, 1.32)	0.96 (0.70, 1.31)	0.98 (0.69, 1.41)
	>2	9	2.66	0.84 (0.43, 1.63)	0.82 (0.42, 1.60)	0.99 (0.49, 2.03)
ALL	none	303	2.64	1.00	1.00	1.00
	>0-2	38	2.37	0.97 (0.68, 1.38)	0.97 (0.68, 1.39)	1.04 (0.71, 1.54)
	>2	6	1.78	0.72 (0.32, 1.64)	0.72 (0.32, 1.64)	0.79 (0.32, 1.93)
AML	none	57	0.50	1.00	1.00	1.00
	>0-2	10	0.62	1.25 (0.62-2.53)	1.17 (0.57-2.38)	1.12 (0.45-2.82)
	>2	3	0.89	1.78 (0.55-5.77)	1.57 (0.48-5.11)	2.62 (0.77-8.85)

Lymphoma	none	242	2.11	1.00	1.00	1.00
	>0-2	37	2.31	1.08 (0.76, 1.55)	1.11 (0.77, 1.60)	1.25 (0.83, 1.91)
	>2	9	2.66	1.25 (0.64, 2.44)	1.27 (0.65, 2.49)	1.24 (0.54, 2.85)
NHL	none	130	1.13	1.00	1.00	1.00
	>0-2	19	1.19	1.04 (0.63-1.71)	1.06 (0.64-1.77)	1.03 (0.57-1.87)
	>2	7	2.07	1.80 (0.83-3.91)	1.84 (0.85-4.01)	1.44 (0.52-4.00)
CNS tumours	none	309	2.69	1.00	1.00	1.00
	>0-2	32	2.00	0.89 (0.61, 1.30)	0.95 (0.64, 1.39)	0.90 (0.57, 1.41)
	>2	7	2.07	0.92 (0.43, 1.96)	0.98 (0.46, 2.10)	1.35 (0.63, 2.89)
Glioma	none	177	1.54	1.00	1.00	1.00
	>0-2	21	1.31	1.09 (0.68, 1.77)	1.13 (0.69, 1.83)	1.15 (0.66, 2.01)
	>2	4	1.18	0.98 (0.36, 2.68)	1.04 (0.38, 2.83)	1.42 (0.52, 3.93)

Abbreviations: ALL acute lymphoblastic leukaemia, CNS central nervous system, HR hazard ratio, IR Incidence ratio, PY person years

^a Number of cases in the minimally adjusted model. The total number of cases (any cancer) was 1318, 1311, and 1059 in the minimally partial, partially and fully adjusted models respectively for maternal exposure and 1513, 1502, and 1224 respectively for paternal exposure.

^b Adjusted for sex, year of birth, and census (1990, 2000)

^c Additionally (to ^b) adjusted for education, crowding, neighbourhood socioeconomic position, background ionizing radiation, and electromagnetic fields from radio and TV transmitters, and distance to nearest highway, petroleum refinery, petrol station, and motor vehicle service station.

^d Additionally (to ^c) adjusted for birth order and birth weight (only includes children born in Switzerland and linked with birth registry data)

^e Product of the proportion of workers exposed and the level of exposure [ppm] (at time of census) based on a job exposure matrix (BEN-JEM) and occupation at census.

Table S6: Sensitivity analyses including only children born in Switzerland - Association between parental occupational exposure to benzene and childhood cancer

Outcome	Exposure category	Cases ^a	IR per 100,000 PY	Minimally adjusted model ^b HR (95% CI)	Partially adjusted model ^c HR (95% CI)	Fully adjusted model ^d HR (95% CI)
Maternal exposure^e						
Any Cancer	none	927	11.51	1.00	1.00	1.00
	>0	54	12.72	1.18 (0.89, 1.56)	1.18 (0.89, 1.57)	1.22 (0.88, 1.69)
Leukaemia	none	253	3.14	1.00	1.00	1.00
	>0	23	5.42	1.93 (1.25, 2.98)	1.90 (1.22, 2.95)	2.36 (1.46, 3.81)
ALL	none	201	2.50	1.00	1.00	1.00
	>0	19	4.48	2.05 (1.27, 3.32)	2.06 (1.27, 3.35)	2.71 (1.63, 4.51)
AML	none	40	0.50	1.00	1.00	1.00
	>0	3	0.71	1.41 (0.43-4.62)	1.22 (0.37-4.05)	0.65 (0.09-4.88)
Lymphoma	none	177	2.20	1.00	1.00	1.00
	>0	5	1.18	0.51 (0.21, 1.25)	0.53 (0.22, 1.30)	0.43 (0.13, 1.35)
NHL	none	101	1.25	1.00	1.00	1.00
	>0	2	0.47	0.37 (0.09-1.52)	0.40 (0.10-1.62)	0.27 (0.04-1.98)
CNS tumours	none	216	2.68	1.00	1.00	1.00
	>0	7	1.65	0.74 (0.35, 1.58)	0.73 (0.34, 1.56)	0.40 (0.13, 1.28)
Glioma	none	130	1.61	1.00	1.00	1.00
	>0	3	0.71	0.58 (0.18, 1.85)	0.58 (0.18, 1.83)	0.22 (0.03, 1.61)
Paternal Exposure^e						
Any Cancer	none	1236	11.71	1.00	1.00	1.00
	>0-2	166	10.99	0.97 (0.82, 1.15)	1.00 (0.84, 1.18)	1.03 (0.85, 1.24)
	>2	41	13.12	1.16 (0.85, 1.59)	1.18 (0.86, 1.62)	1.22 (0.85, 1.75)
Leukaemia	none	370	3.50	1.00	1.00	1.00
	>0-2	47	3.11	0.95 (0.69, 1.30)	0.94 (0.69, 1.30)	1.00 (0.70, 1.42)
	>2	9	2.88	0.87 (0.45, 1.70)	0.85 (0.44, 1.67)	1.01 (0.50, 2.06)
ALL	none	291	2.76	1.00	1.00	1.00
	>0-2	37	2.45	0.97 (0.68, 1.38)	0.97 (0.68, 1.40)	1.06 (0.71, 1.57)
	>2	6	1.92	0.75 (0.33, 1.70)	0.75 (0.33, 1.71)	0.80 (0.33, 1.96)
AML	none	52	0.49	1.00	1.00	1.00
	>0-2	9	0.60	1.15 (0.55-2.39)	1.06 (0.50-2.22)	1.13 (0.45-2.83)
	>2	3	0.96	1.84 (0.57-6.00)	1.61 (0.49-5.25)	2.65 (0.78-8.95)
Lymphoma	none	230	2.18	1.00	1.00	1.00

	>0-2	36	2.38	1.08 (0.75, 1.55)	1.12 (0.77, 1.62)	1.26 (0.83, 1.91)
	>2	9	2.88	1.30 (0.66, 2.55)	1.33 (0.68, 2.61)	1.26 (0.55, 2.87)
NHL	none	125	1.18	1.00	1.00	1.00
	>0-2	18	1.19	1.00 (0.60-1.66)	1.02 (0.61-1.72)	1.03 (0.57-1.87)
	>2	7	2.24	1.87 (0.86-4.05)	1.90 (0.87-4.15)	1.45 (0.52-4.02)
CNS tumours	none	295	2.79	1.00	1.00	1.00
	>0-2	31	2.05	0.87 (0.59, 1.28)	0.94 (0.63, 1.39)	0.89 (0.57, 1.40)
	>2	7	2.24	0.95 (0.45, 2.03)	1.02 (0.48, 2.18)	1.34 (0.62, 2.89)
Glioma	none	166	1.57	1.00	1.00	1.00
	>0-2	20	1.32	1.07 (0.66, 1.74)	1.11 (0.68, 1.83)	1.14 (0.66, 2.00)
	>2	4	1.28	1.03 (0.38, 2.81)	1.09 (0.40, 2.99)	1.42 (0.52, 3.92)

Abbreviations: ALL acute lymphoblastic leukaemia, CNS central nervous system, HR hazard ratio, IR Incidence ratio, PY person years

^a Number of cases in the minimally adjusted model. The total number of cases (any cancer) was 981, 977, and 768 in the minimally partial, partially and fully adjusted models respectively for maternal exposure and 1443, 1433, and 1188 respectively for paternal exposure.

^b Adjusted for sex, year of birth, and census (1990, 2000)

^c Additionally (to ^b) adjusted for education, crowding, neighbourhood socioeconomic position, background ionizing radiation, and electromagnetic fields from radio and TV transmitters, and distance to nearest highway, petroleum refinery, petrol station, and motor vehicle service station.

^d Additionally (to ^c) adjusted for birth order and birth weight (only includes children born in Switzerland and linked with birth registry data)

^e Product of the proportion of workers exposed and the level of exposure [ppm] (at time of census) based on a job exposure matrix (BEN-JEM) and occupation at census.

Table S7: Sensitivity analyses including only children linked to a birth record - Association between parental occupational exposure to benzene and childhood cancer

Outcome	Exposure category	Cases ^a	IR per 100,000 PY	Minimally adjusted model ^b HR (95% CI)	Partially adjusted model ^c HR (95% CI)	Fully adjusted model ^d HR (95% CI)
Maternal exposure^e						
Any Cancer	none	777	13.01	1.00	1.00	1.00
	>0	41	14.45	1.16 (0.84-1.59)	1.17 (0.85-1.61)	1.20 (0.87-1.66)
Leukaemia	none	218	3.65	1.00	1.00	1.00
	>0	20	7.05	2.11 (1.32-3.38)	2.11 (1.31-3.39)	2.31 (1.43-3.73)
ALL	none	175	2.93	1.00	1.00	1.00
	>0	18	6.35	2.38 (1.45-3.92)	2.41 (1.45-4.00)	2.63 (1.58-4.38)
AML	none	33	0.55	1.00	1.00	1.00
	>0	1	0.35	0.66 (0.09-4.90)	0.57 (0.08-4.31)	0.65 (0.09-4.88)
Lymphoma	none	142	2.38	1.00	1.00	1.00
	>0	3	1.06	0.41 (0.13-1.30)	0.41 (0.13-1.29)	0.42 (0.13-1.34)
NHL	none	83	1.39	1.00	1.00	1.00
	>0	1	0.35	0.24 (0.03-1.76)	0.25 (0.03-1.84)	0.27 (0.04-1.96)
CNS	none	185	3.10	1.00	1.00	1.00
	>0	3	1.06	0.40 (0.13-1.24)	0.40 (0.13-1.26)	0.40 (0.13-1.26)
Glioma	none	115	1.93	1.00	1.00	1.00
	>0	1	0.35	0.23 (0.03-1.67)	0.23 (0.03-1.64)	0.22 (0.03-1.60)
Paternal Exposure^e						
Any Cancer	none	1064	12.81	1.00	1.00	1.00
	>0-2	133	12.17	0.96 (0.80-1.16)	1.00 (0.82-1.21)	1.03 (0.85-1.25)
	>2	32	14.30	1.13 (0.79-1.61)	1.16 (0.81-1.66)	1.21 (0.85-1.73)
Leukaemia	none	321	3.86	1.00	1.00	1.00
	>0-2	38	3.48	0.94 (0.66-1.34)	0.95 (0.67-1.36)	0.99 (0.69-1.42)
	>2	8	3.58	0.96 (0.47-1.95)	0.95 (0.47-1.93)	1.00 (0.49-2.04)
ALL	none	258	3.11	1.00	1.00	1.00
	>0-2	32	2.93	0.99 (0.67-1.45)	1.02 (0.69-1.50)	1.05 (0.71-1.55)
	>2	5	2.23	0.75 (0.31-1.82)	0.76 (0.31-1.85)	0.79 (0.32-1.94)
AML	none	41	0.49	1.00	1.00	1.00
	>0-2	6	0.55	1.12 (0.46-2.77)	1.02 (0.41-2.52)	1.14 (0.45-2.86)
	>2	3	1.34	2.73 (0.82-9.12)	2.31 (0.69-7.76)	2.66 (0.79-9.00)
Lymphoma	none	187	2.25	1.00	1.00	1.00

	>0-2	29	2.65	1.15 (0.76-1.73)	1.21 (0.80-1.84)	1.26 (0.83-1.91)
	>2	6	2.68	1.16 (0.51-2.65)	1.20 (0.53-2.75)	1.25 (0.55-2.86)
NHL	none	105	1.26	1.00	1.00	1.00
	>0-2	14	1.28	0.98 (0.54-1.75)	0.98 (0.54-1.77)	1.03 (0.57-1.87)
	>2	4	1.79	1.36 (0.49-3.74)	1.36 (0.49-3.76)	1.45 (0.52-4.01)
CNS	none	254	3.06	1.00	1.00	1.00
	>0-2	23	2.11	0.81 (0.52-1.27)	0.89 (0.57-1.40)	0.89 (0.57-1.40)
	>2	7	3.13	1.20 (0.56-2.57)	1.32 (0.62-2.84)	1.34 (0.62-2.87)
Glioma	none	146	1.76	1.00	1.00	1.00
	>0-2	16	1.46	1.07 (0.62-1.85)	1.16 (0.66-2.01)	1.14 (0.66-1.99)
	>2	4	1.79	1.30 (0.47-3.56)	1.42 (0.51-3.91)	1.41 (0.51-3.90)

Abbreviations: ALL acute lymphoblastic leukaemia, CNS central nervous system, HR hazard ratio, IR Incidence ratio, PY person years

^a Number of cases in the minimally adjusted model. The total number of cases (any cancer) was 818, 814, and 773 in the minimally partial, partially and fully adjusted models respectively for maternal exposure and 1229, 1220, and 1196 respectively for paternal exposure.

^b Adjusted for sex, year of birth, and census (1990, 2000)

^c Additionally (to ^b) adjusted for education, crowding, neighbourhood socioeconomic position, background ionizing radiation, and electromagnetic fields from radio and TV transmitters, and distance to nearest highway, petroleum refinery, petrol station, and motor vehicle service station.

^d Additionally (to ^c) adjusted for birth order and birth weight (only includes children born in Switzerland and linked with birth registry data)

^e Product of the proportion of workers exposed and the level of exposure [ppm] (at time of census) based on a job exposure matrix (BEN-JEM) and occupation at census.

Table S8: Sensitivity analyses including only children aged 0-4 years at census - Association between parental occupational exposure to benzene and childhood cancer

Outcome	Exposure category	Cases ^a	IR per 100,000 PY	Minimally adjusted model ^b HR (95% CI)	Partially adjusted model ^c HR (95% CI)	Fully adjusted model ^d HR (95% CI)
Maternal exposure^e						
Any Cancer	none	462	12.80	1.00	1.00	1.00
	>0	25	13.65	1.15 (0.76-1.72)	1.18 (0.79-1.79)	1.35 (0.88-2.08)
Leukaemia	none	149	4.13	1.00	1.00	1.00
	>0	15	8.19	2.10 (1.22-3.62)	2.11 (1.22-3.66)	2.46 (1.39-4.36)
Lymphoma	none	67	1.86	1.00	1.00	1.00
	>0	2	1.09	0.60 (0.15-2.49)	0.67 (0.16-2.78)	0.83 (0.20-3.47)
CNS	none	111	3.07	1.00	1.00	1.00
	>0	0	0.00	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-NA)
Paternal Exposure^e						
Any Cancer	none	627	12.56	1.00	1.00	1.00
	>0-2	75	11.15	0.95 (0.74-1.22)	0.96 (0.74-1.24)	0.99 (0.76-1.29)
	>2	18	12.69	1.08 (0.67-1.73)	1.10 (0.68-1.77)	1.19 (0.73-1.94)
Leukaemia	none	219	4.39	1.00	1.00	1.00
	>0-2	28	4.16	1.00 (0.66-1.51)	0.97 (0.64-1.48)	1.06 (0.69-1.63)
	>2	4	2.82	0.67 (0.25-1.82)	0.64 (0.24-1.74)	0.74 (0.27-2.02)
Lymphoma	none	85	1.70	1.00	1.00	1.00
	>0-2	9	1.34	0.82 (0.40-1.67)	0.84 (0.41-1.73)	0.74 (0.33-1.66)
	>2	2	1.41	0.86 (0.21-3.54)	0.90 (0.22-3.72)	1.05 (0.25-4.39)
CNS	none	152	3.04	1.00	1.00	1.00
	>0-2	12	1.78	0.73 (0.40-1.35)	0.77 (0.42-1.44)	0.85 (0.46-1.59)
	>2	5	3.53	1.44 (0.58-3.56)	1.58 (0.63-3.92)	1.81 (0.73-4.52)

Abbreviations: ALL acute lymphoblastic leukaemia, CNS central nervous system, HR hazard ratio, IR Incidence ratio, NA not available, PY person years

^a Number of cases in the minimally adjusted model. The total number of cases (any cancer) was 487, 484, and 419 in the minimally partial, partially and fully adjusted models respectively for maternal exposure and 720, 713, and 655 respectively for paternal exposure.

^b Adjusted for sex, year of birth, and census (1990, 2000)

^c Additionally (to ^b) adjusted for education, crowding, neighbourhood socioeconomic position, background ionizing radiation, and electromagnetic fields from radio and TV transmitters, and distance to nearest highway, petroleum refinery, petrol station, and motor vehicle service station.

^d Additionally (to ^c) adjusted for birth order and birth weight (only includes children born in Switzerland and linked with birth registry data)

^e Product of the proportion of workers exposed and the level of exposure [ppm] (at time of census) based on a job exposure matrix (BEN-JEM) and occupation at census.