

Table S3: Effect of migration adjustment of person year totals by city, sex, birth cohort (age at exposure), and time period

Age at exposure	1950-1959			1960-69			1970-79			1980-89			1990-2001		
	Adj. PY	Unadj. PY	% dec.	Adj. PY	Unadj. PY	% dec.	Adj. PY	Unadj. PY	% dec.	Adj. PY	Unadj. PY	% dec.	Adj. PY	Unadj. PY	% dec.
Hiroshima Men															
0-19	126,852	137,619	7.8	114,076	136,031	16.1	106,458	132,442	19.6	100,573	125,574	19.9	96,723	121,053	20.1
20-39	61,510	63,465	3.1	55,125	58,002	5.0	46,973	49,243	4.6	34,181	35,857	4.7	19,042	20,051	5.0
40+	95,187	97,603	2.5	63,310	66,130	4.3	32,804	34,446	4.8	11,170	11,754	5.0	1,827	1,924	5.1
Hiroshima Women															
0-19	143,551	153,053	6.2	133,376	153,593	13.2	125,313	150,083	16.5	120,205	144,560	16.8	122,802	147,798	16.9
20-39	150,230	154,705	2.9	144,321	151,557	4.8	133,314	139,822	4.7	114,073	119,623	4.6	88,206	92,751	4.9
40+	123,864	126,469	2.1	94,156	97,656	3.6	58,718	61,227	4.1	27,386	28,611	4.3	7,068	7,393	4.4
Nagasaki Men															
0-19	70,109	79,544	11.9	55,923	75,927	26.3	49,395	73,718	33.0	46,096	69,699	33.9	44,517	67,643	34.2
20-39	22,858	24,050	5.0	19,627	21,518	8.8	16,654	18,313	9.1	12,100	13,361	9.4	6,864	7,650	10.3
40+	35,699	37,115	3.8	21,022	22,671	7.3	10,292	11,266	8.6	3,429	3,776	9.2	572	631	9.4
Nagasaki Women															
0-19	79,751	88,469	9.9	65,972	84,886	22.3	59,224	82,941	28.6	56,397	80,084	29.6	57,935	82,401	29.7
20-39	56,810	59,589	4.7	50,094	54,805	8.6	46,058	50,727	9.2	39,752	43,881	9.4	31,930	35,444	9.9
40+	44,614	46,078	3.2	30,046	31,997	6.1	17,873	19,294	7.4	7,609	8,255	7.8	1,790	1,948	8.1

**Table S4: Crude rates (per 10,000 PY) for leukemia other than CLL or ATL
by age at exposure , period, and dose**

		1950-59			1960-69			1970-79			1980-89			1990-2001			Total		
		<0.005	0.005-1	≥ 1	<0.005	0.005-1	≥ 1	<0.005	0.005-1	≥ 1	<0.005	0.005-1	≥ 1	<0.005	0.005-1	≥ 1	<0.005	0.005-1	≥ 1
<i>Leukemia other than CLL or ATL</i>																			
0-19	Rate	0.17	0.86	13.52	0.33	0.33	2.01	0.10	0.58	1.12	0.43	0.46	3.71	0.76	0.84	5.55	0.35	0.62	5.65
	Cases	4	15	16	7	5	2	2	8	1	8	6	3	14	11	4	35	45	26
20-39	Rate	0.12	0.33	11.16	0.39	0.74	4.27	1.01	1.64	4.93	1.21	1.13	4.35	1.88	1.73	20.42	0.79	1.01	8.01
	Cases	2	4	9	6	8	3	14	16	3	14	9	2	16	10	6	52	47	23
≥ 40	Rate	0.69	1.06	8.52	0.34	1.26	8.73	1.50	0.99	12.47	1.43	2.90	21.41	6.18	0	0	0.87	1.22	9.89
	Cases	11	14	6	4	11	4	10	5	3	4	6	2	4	0	0	33	36	15
<i>AML</i>																			
0-19	Rate	0.09	0.23	4.23	0.24	0.13	0	0.10	0.36	0	0.33	0.23	3.71	0.38	0.69	4.17	0.22	0.32	2.39
	Cases	2	4	5	5	2	0	2	5	0	6	3	3	7	9	3	22	23	11
20-39	Rate	0.12	0.25	1.24	0.13	0.28	2.85	0.65	1.13	1.64	1.04	0.88	4.35	1.29	1.21	13.61	0.55	0.67	3.48
	Cases	2	3	1	2	3	2	9	11	1	12	7	2	11	7	4	36	31	10
≥ 40	Rate	0.37	0.23	4.26	0.17	0.46	8.73	1.05	0.79	8.31	1.07	1.45	10.71	1.54	0	0	0.50	0.47	6.60
	Cases	6	3	3	2	4	4	7	4	2	3	3	1	1	0	0	19	14	10
<i>ALL</i>																			
0-19	Rate	0	0.34	5.92	0.05	0.13	1.01	0	0.07	0	0	0.08	0	0.05	0.08	1.39	0.02	0.15	1.96
	Cases	0	6	7	1	2	1	0	1	0	0	1	0	1	1	1	2	11	9
20-39	Rate	0	0	1.24	0.13	0	1.42	0.07	0.10	1.64	0.09	0.13	0	0	0.17	0	0.06	0.06	1.04
	Cases	0	0	1	2	0	1	1	1	1	1	1	0	0	1	0	4	3	3
≥ 40	Rate	0.19	0.23	1.42	0.09	0.11	0	0	0	0	0	0.48	0	1.54	0	0	0.13	0.17	0.66
	Cases	3	3	1	1	1	0	0	0	0	0	1	0	1	0	0	5	5	1
<i>CML</i>																			
0-19	Rate	0	0.29	2.54	0.05	0.07	1.01	0	0.14	1.12	0.11	0.08	0	0.27	0.08	0	0.08	0.14	1.09
	Cases	0	5	3	1	1	1	0	2	1	2	1	0	5	1	0	8	10	5
20-39	Rate	0	0.08	8.68	0.13	0.37	0	0.29	0.31	1.64	0.09	0.13	0	0.35	0.17	0	0.15	0.22	2.79
	Cases	0	1	7	2	4	0	4	3	1	1	1	0	3	1	0	10	10	8
≥ 40	Rate	0	0.60	2.84	0.09	0.57	0	0.15	0.20	4.16	0.36	0.97	10.71	1.54	0	0	0.11	0.54	2.64
	Cases	0	8	2	1	5	0	1	1	1	1	2	1	1	0	0	4	16	4
PY	0-19	234,693	174,343	11,834	209,588	149,753	9,945	193,245	138,189	8,926	183,921	131,216	8,096	183,601	130,692	7,201	1,005,050	724,193	46,005
	20-39	162,743	121,048	8,063	153,890	108,212	7,022	139,303	97,554	6,089	115,495	79,919	4,601	85,084	57,756	2,939	656,515	464,490	28,716
	≥ 40	160,285	132,427	7,046	116,273	87,505	4,584	66,586	50,575	2,406	27,910	20,673	934	6,477	4,562	190	377,531	295,744	15,161

**Table S5: Crude rates (per 10,000 PY) for lymphoma and myeloma
by age at exposure, period, and dose**

		1950–59			1960–69			1970–79			1980–89			1990–2001			Total		
		<0.005	0.005–1	≥ 1	<0.005	0.005–1	≥ 1	<0.005	0.005–1	≥ 1	<0.005	0.005–1	≥ 1	<0.005	0.005–1	≥ 1	<0.005	0.005–1	≥ 1
<i>Non-Hodgkin Lymphoma</i>																			
0-19	Rate	0	0.17	0.85	0.38	0.07	0	0.36	0.43	0	0.87	1.07	1.24	2.02	2.22	5.55	0.68	0.73	1.30
	Cases	0	3	1	8	1	0	7	6	0	16	14	1	37	29	4	68	53	6
20-39	Rate	0.18	0.33	0	0.39	0.65	2.85	1.58	1.33	3.28	3.20	2.25	2.17	4.23	5.54	3.40	1.58	1.59	2.09
	Cases	3	4	0	6	7	2	22	13	2	37	18	1	36	32	1	104	74	6
≥ 40	Rate	0.81	0.23	1.42	1.20	1.71	2.18	2.25	1.98	0	3.22	1.93	10.71	4.63	4.38	0	1.43	1.15	1.98
	Cases	13	3	1	14	15	1	15	10	0	9	4	1	3	2	0	54	34	3
<i>Hodgkin Lymphoma</i>																			
0-19	Rate	0.04	0	0	0.10	0	0	0	0	0	0.05	0.08	0	0.05	0	0	0.05	0.01	0
	Cases	1	0	0	2	0	0	0	0	0	1	1	0	1	0	0	5	1	0
20-39	Rate	0.06	0.17	0	0.19	0.09	0	0.07	0.10	0	0	0	0	0.24	0	0	0.11	0.09	0
	Cases	1	2	0	3	1	0	1	1	0	0	0	0	2	0	0	7	4	0
≥ 40	Rate	0.12	0.23	1.42	0.26	0.34	0	0.60	0.40	0	0	0	0	0	0	0	0.24	0.27	0.66
	Cases	2	3	1	3	3	0	4	2	0	0	0	0	0	0	0	9	8	1
<i>Multiple Myeloma</i>																			
0-19	Rate	0	0	0	0	0	0	0.10	0.07	0	0	0.61	1.24	0.54	0.54	0	0.12	0.22	0.22
	Cases	0	0	0	0	0	0	2	1	0	0	8	1	10	7	0	12	16	1
20-39	Rate	0.06	0.17	1.24	0	0	0	0.72	0.41	1.64	0.87	1.38	2.17	1.53	1.73	0	0.52	0.58	1.04
	Cases	1	2	1	0	0	0	10	4	1	10	11	1	13	10	0	34	27	3
≥ 40	Rate	0	0.08	0	0.26	0.57	0	1.50	1.98	0	3.58	1.93	0	0	0	0	0.61	0.68	0
	Cases	0	1	0	3	5	0	10	10	0	10	4	0	0	0	0	23	20	0

Table S6: Alternative models for leukemia other than CLL or ATL

Dose	Effect modifiers‡	Deviance	Parms.	AIC	dose	dose^2	log(age)	log(age)^2	log(tsx)	log(tsx)^2	agex	agex^2	F:M ratio	N:H ratio	agex*log(age)
Excess relative risk (ERR) models. Dose effects are ERRs at 1 Gy at age 70 following exposure at age 30 (40 years since exposure)															
L-Q	age, tsx	2403.89	14	2431.89	0.79	0.95	-1.09	(>0.5)	-0.81	(>0.5)	(>0.5)	(0.12)	(0.29)	(0.41)	(0.34)
L	age, tsx	2413.99	13	2439.99	2.11	(0.001)	-1.21	-0.44	-0.78	(>0.5)	(>0.5)	(0.11)	(0.36)	(0.40)	(0.43)
Q	age, tsx	2408.06	13	2434.06	(0.04)	1.41	-0.96	(>0.5)	-0.82	(>0.5)	(>0.5)	(0.16)	(0.28)	(>0.5)	(0.34)
L-Q	age	2412.45	13	2438.45	0.97	1.19	-1.82	(0.42)	(0.003)	(0.009)	(0.01)	(0.23)	(0.37)	(0.39)	(0.21)
L-Q	agex	2440.00	13	2466.00	1.28	2.22	(<0.001)	(<0.001)	(<0.001)	(<0.001)	-0.18	(0.001)	(>0.5)	(0.43)	(0.001)
L-Q	tsx	2410.88	13	2436.88	0.76	1.14	(0.01)	(0.05)	-1.18	(>0.5)	(0.02)	(0.05)	(0.31)	(>0.5)	(0.009)
L-Q	age, agex	2405.97	14	2433.97	0.83	1.00	-2.63	(0.10)	(0.13)	(0.24)	0.37	(0.27)	(0.28)	(0.44)	(>0.5)
L-Q	tsx, agex	2405.43	14	2433.43	0.78	0.98	(0.21)	(0.46)	-1.28	(0.43)	-0.25	(0.05)	(0.31)	(0.40)	(0.10)
L-Q	age, tsx, sex	2402.78	15	2432.78	0.66	0.83	-1.10	(>0.5)	-0.82	(>0.5)	(>0.5)	(0.09)	1.37	(0.41)	(0.30)
L-Q	age, tsx, city	2403.23	15	2433.23	0.86	1.01	-1.11	(>0.5)	-0.7992	(>0.5)	(>0.5)	(0.12)	(0.29)	0.73	(0.37)
Excess absolute rate (EAR) models. Dose effect EAR's are excess cases per 10,000 persons years at 1 Gy at age 70 following exposure at age 30 (40 years after exposure)															
L-Q	age, agex, city, sex	2401.22	16	2433.22	1.06	1.09	-1.45	(0.14)	(>0.5)	(>0.5)	0.41	(>0.5)	0.66	0.52	(0.43)
L	age, agex, city, sex	2410.82	15	2440.82	2.50	(0.002)	-1.37	(0.16)	(>0.5)	(>0.5)	0.38	(>0.5)	0.63	0.55	(>0.5)
Q	age, agex, city, sex	2407.27	15	2437.27	(0.01)	1.74	-1.52	(0.12)	(>0.5)	(0.48)	0.43	(>0.5)	0.68	0.52	(0.41)
L-Q	age, agex	2409.00	14	2437.00	0.66	0.74	-1.54	(0.12)	(>0.5)	(>0.5)	0.45	(>0.5)	(0.09)	-0.04	(0.31)
L-Q	age, agex, sex	2406.09	15	2436.09	0.91	0.91	-1.47	(0.12)	(>0.5)	(>0.5)	0.43	(>0.5)	0.67	(0.03)	(0.35)
L-Q	age, agex, city	2404.39	15	2434.39	0.75	0.88	-1.51	(0.14)	(>0.5)	(>0.5)	0.43	(>0.5)	(0.07)	0.53	(0.37)
L-Q	age, city, sex	2416.49	15	2446.49	1.34	1.36	-0.58	(0.002)	(0.001)	(<0.001)	(<0.001)	(>0.5)	0.64	0.50	(>0.5)
L-Q	tsx, city, sex	2406.94	15	2436.94	1.05	1.07	(>0.5)	(0.09)	-0.72	(0.36)	(>0.5)	(0.26)	0.64	0.50	(0.19)
L-Q	agex, city, sex	2420.43	15	2450.43	2.16	1.97	(<0.001)	(<0.001)	(<0.001)	(<0.001)	-0.48	(0.19)	0.62	0.50	(<0.001)
L-Q	agex, tsx, city, sex	2406.80	16	2438.80	1.09	1.10	(0.01)	(0.002)	-0.70	(0.34)	0.03	(0.24)	0.64	0.51	(0.008)
L-Q	age, tsx, city, sex	2406.69	16	2438.69	1.00	1.03	-0.13	(0.002)	-0.67	(0.34)	(0.02)	(0.30)	0.64	0.50	(0.015)
L-Q	1994 model: categorical agex, tsx, sex, sex*tsx	2408.50	19	2446.50	†	†	(0.07)	(0.01)	†	(0.05)	(>0.5)	(0.04)	†	(0.05)	(0.04)

‡ Effect modification was model as a log linear function of various covariates: The following abbreviations are used: *age* - attained age; *agex* - age at exposure; *tsx* - time since exposure. If LQ is included after an effect it means that both linear and quadratic terms for this effect were included in the model. For models that include sex or city effects the estimates are presented as the Female:Male or Nagasaki:Hiroshima ERR (EAR) ratios.

* Score test P-values shown in parentheses.

† The 1994 model was an linear-quadratic dose response model in which the linear dose effect and the time since exposure effect modification varied with age at exposure category and sex. The curvature of the dose response was independent of both age at exposure category and sex.

Table S7: Alternative models for the acute myeloid leukemia excess risk

Dose	Effect modifiers‡	Deviance	Parms.	AIC	dose	dose^2	log(age)	log(age)^2	log(tsx)	log(tsx)^2	agex	agex^2	F:M ratio	N:H ratio	agex*log(age)	agex*log(tsx)	fem*log(age)	fem*log(tsx)	fem*e30
Excess relative risk (ERR) models. Dose effects are ERRs at 1 Gy at age 70 following exposure at age 30 (40 years since exposure)																			
Q	age, agex (LQ)	1522.14	15	1552.14	(>0.5)*	1.11	-0.89	(>0.5)	(>0.5)	(>0.5)	0.17	0.25	(0.16)	(0.35)	(>0.5)	(>0.5)	(>0.5)	(>0.5)	(>0.5)
L-Q	age, agex (LQ)	1522.10	16	1554.10	0.08	1.06	-0.89	(>0.5)	(>0.5)	(>0.5)	0.17	0.25	(0.16)	(0.34)	(>0.5)	(>0.5)	(>0.5)	(>0.5)	(>0.5)
L	age, agex (LQ)	1533.85	15	1563.85	1.61	(<0.001)	-0.89	(0.29)	(>0.5)	(>0.5)	0.13	0.24	(0.17)	(0.32)	(>0.5)	(>0.5)	(>0.5)	(>0.5)	(>0.5)
Q	age, agex	1530.63	14	1558.63	(>0.5)	1.80	-1.60	(>0.5)	(>0.5)	(>0.5)	0.30	(0.003)	(0.25)	(0.31)	(0.24)	(0.27)	(>0.5)	(>0.5)	(>0.5)
Q	age	1533.07	13	1559.07	(>0.5)	1.95	-1.03	(>0.5)	(0.25)	(>0.5)	(0.13)	(<0.001)	(0.26)	(0.23)	(0.31)	(0.30)	(>0.5)	(>0.5)	(0.43)
Q	age, agex (LQ), sex	1520.16	16	1552.16	(>0.5)	0.82	-0.87	(0.48)	(>0.5)	(>0.5)	0.17	0.26	1.87	(0.17)	(0.37)	(>0.5)	(>0.5)	(>0.5)	(>0.5)
Q	age, agex (LQ), city	1521.18	16	1553.18	(>0.5)	1.23	-0.95	(0.48)	(>0.5)	(>0.5)	0.16	0.25	(0.17)	0.63	(>0.5)	(>0.5)	(>0.5)	(>0.5)	(>0.5)
Q	tsx, agex (LQ)	1522.41	15	1552.41	(>0.5)	1.06	(>0.5)	(>0.5)	-0.45	(0.35)	-0.03	0.26	(0.15)	(0.34)	(>0.5)	(>0.5)	(>0.5)	(>0.5)	(>0.5)
Q	tsx	1532.62	13	1558.62	(>0.5)	1.87	(0.38)	(0.28)	-0.702	(0.43)	(>0.5)	(0.001)	(0.22)	(0.31)	(0.09)	(>0.5)	(>0.5)	(>0.5)	(>0.5)
Q	agex (LQ)	1523.97	14	1551.97	(>0.5)	1.20	(0.18)	(0.39)	(0.20)	(>0.5)	0.03	0.29	(0.15)	(0.39)	(0.44)	(0.46)	(0.37)	(>0.5)	(>0.5)
Q	none	1537.14	12	1561.14	(0.04)	2.42	(0.04)	(0.04)	(0.03)	(0.49)	(>0.5)	(<0.001)	(0.24)	(0.29)	(0.02)	(>0.5)	(0.12)	(0.22)	(>0.5)
Excess absolute rate (EAR) models. Dose effect EAR's are excess cases per 10,000 persons years at 1 Gy at age 70 following exposure at age 30 (40 years after exposure)																			
Q	age (LQ)	1521.95	14	1549.95	(>0.5)	1.59	2.59	1.43	(>0.5)	(>0.5)	(0.48)	(0.12)	(>0.5)	(0.32)	(>0.5)	(0.32)	(>0.5)	(>0.5)	(>0.5)
L-Q	age (LQ)	1521.95	15	1551.95	-0.004	1.59	2.59	1.43	(>0.5)	(>0.5)	(0.47)	(0.12)	(>0.5)	(0.32)	(>0.5)	(0.32)	(>0.5)	(>0.5)	(>0.5)
L	age (LQ)	1537.36	14	1565.36	1.79	(<0.001)	1.81	1.03	(>0.5)	(>0.5)	(0.43)	(0.07)	(0.38)	(0.09)	(>0.5)	(0.23)	(>0.5)	(>0.5)	(>0.5)
Q	age (LQ), tsx	1525.18	15	1555.18	(>0.5)	1.37	2.53	1.33	-0.29	(0.39)	(0.47)	(0.07)	(>0.5)	(0.10)	(0.17)	(0.32)	(>0.5)	(>0.5)	(>0.5)
Q	age (LQ), agex	1524.82	15	1554.82	(>0.5)	1.34	1.66	1.13	(>0.5)	(>0.5)	0.16	(0.08)	(>0.5)	(0.11)	(0.26)	(0.42)	(>0.5)	(>0.5)	(>0.5)
Q	age (LQ), sex	1525.48	15	1555.48	(>0.5)	1.73	2.32	1.31	(0.40)	(>0.5)	(0.31)	(0.05)	-0.24	(0.08)	(>0.5)	(0.18)	(0.43)	(0.47)	(>0.5)
Q	age (LQ), city	1522.66	15	1552.66	(>0.5)	1.73	2.09	1.22	(>0.5)	(>0.5)	(0.44)	(0.07)	(>0.5)	-0.87	(>0.5)	(0.245)	(>0.5)	(>0.5)	(>0.5)
Q	age	1531.76	13	1557.76	(>0.5)	1.15	0.35	(0.003)	(0.49)	(>0.5)	(0.11)	(0.01)	(>0.5)	(0.06)	(0.04)	(0.36)	(>0.5)	(>0.5)	(>0.5)
Q	1994 categorical agex, tsx with interactions†	1523.37	17	1557.37	(>0.5)	+	(0.47)	(0.10)	+	(0.44)	(>0.05)	(0.01)	(>0.5)	(0.34)	(0.11)	(0.26)	(>0.5)	(0.49)	(>0.5)

‡ Effect modification was model as a log linear function of various covariates: The following abbreviations are used: *age* - attained age; *agex* - age at exposure; *tsx* - time since exposure. If LQ is included after an effect it means that both linear and quadratic terms for this effect were included in the model. For models that include sex or city effects the estimates are presented as the Female:Male or Nagasaki:Hiroshima ERR (EAR) ratios.

* Score test P-values shown in parentheses

† The 1994 model was an linear-quadratic dose response model in which the linear dose effect and the time since exposure effect modification varied with age at exposure category. The curvature of the dose response was independent of age at exposure category. It was not possible to fit the linear quadratic model so we fit a quadratic model in which the shape of the dose response varied with age at exposure category. The EAR estimates (for unit dose-squared) at 40 years after exposure were 0.64, 1.41, and 3.20 for exposure ages of 0-19, 20-39, and 40+, respectively. The EAR changed with times since exposure in proportion to time since exposure to the power -0.19, 0.62, and 0.59, respectively for the three age at exposure groups.

Table S8: Alternative models for the acute lymphocytic leukemia excess risk

Dose	Effect modifiers‡	Deviance	Parms.	AIC	dose	dose^2	log(age)	log(age)^2	log(tsx)	log(tsx)^2	agex	agex^2	F:M ratio	N:H ratio	agex*log(age)
Excess relative risk (ERR) models. Dose effects are ERRs at 1 Gy at age 70 following exposure at age 30 (40 years since exposure)															
L	age, sex	480.43	8	496.43	2.40	(0.349)*	-3.51	(>0.5)	(0.307)	(0.189)	(0.228)	(0.143)	0.40	(>0.5)	(0.336)
L-Q	age, sex	479.53	9	497.53	1.58	0.63	-3.49	(>0.5)	(0.289)	(0.176)	(0.225)	(0.136)	0.40	(>0.5)	(0.31)
Q	age, sex	484.86	8	500.86	(0.0037)	1.73	-3.13	(>0.5)	(0.266)	(0.145)	(0.218)	(0.122)	0.40	(>0.5)	(0.267)
L	age, sex, agex	479.14	9	497.14	2.46	(0.33)	-3.93	(>0.5)	(>0.5)	(>0.5)	0.29	(0.304)	0.40	(>0.5)	(>0.5)
L	age, sex, tsx	479.27	9	497.27	1.92	(0.312)	-3.14	(>0.5)	-0.54	(0.405)	(>0.5)	(0.344)	0.40	(>0.5)	(>0.5)
L	age, sex, city	480.30	9	498.30	2.52	(0.354)	-3.52	(>0.5)	(0.301)	(0.188)	(0.227)	(0.141)	0.40	0.84	(0.327)
L	tsx, sex	493.52	8	509.52	5.25	(0.156)	(<0.001)	(<0.001)	-1.08	(0.14)	(0.0105)	(0.428)	0.34	(>0.5)	(<0.001)
L	tsx, agex, sex	484.72	9	502.72	1.13	(0.209)	(0.00413)	(0.00574)	-2.05	(0.0973)	-0.84	(>0.5)	0.37	(>0.5)	(0.0209)
L	age (LQ), sex	480.37	9	498.37	2.71	(0.354)	-3.20	0.13	(0.267)	(0.185)	(0.24)	(0.131)	0.40	(>0.5)	(0.204)
Excess absolute rate (EAR) model. Dose effects are excess cases per 10,000 person years at 1 Gy at age 70 following exposure at age 30 (40 years after exposure)															
L	age, sex	480.427	8	496.43	0.23	(0.348)	-1.81	(>0.5)	(0.307)	(0.189)	(0.228)	(0.143)	0.40	(>0.5)	(0.336)
L-Q	age, sex	479.533	9	497.53	0.16	0.06	-1.82	(>0.5)	(0.289)	(0.176)	(0.225)	(0.136)	0.40	(>0.5)	(0.31)
Q	age, sex	484.862	8	500.86	(0.00372)	0.17	-1.87	(>0.5)	(0.266)	(0.145)	(0.218)	(0.122)	0.40	(>0.5)	(0.267)
L	age, sex, agex	479.138	9	497.14	0.23	(0.331)	-2.26	(>0.5)	(>0.5)	(>0.5)	0.29	(0.304)	0.40	(>0.5)	(>0.5)
L	age, sex, tsx	479.27	9	497.27	0.19	(0.312)	-1.45	(>0.5)	-0.54	(0.405)	(>0.5)	(0.344)	0.40	(>0.5)	(>0.5)
L	age, sex, city	480.30	9	498.30	0.24	(0.354)	-1.81	(>0.5)	(0.301)	(0.188)	(0.227)	(0.141)	0.40	0.84	(0.327)
L	tsx, sex	489.91	8	505.91	0.30	(0.211)	(<0.001)	(<0.001)	-1.25	(0.166)	(0.00517)	(0.218)	0.37	(>0.5)	(<0.001)
L	agex, sex, tsx	481.25	9	499.25	0.14	(0.275)	(0.121)	(0.15)	-1.44	(>0.5)	-0.48	(>0.5)	0.39	(>0.5)	(0.201)
L	age (LQ), sex	480.37	9	498.37	0.26	(0.355)	-1.51	0.13	(0.267)	(0.185)	(0.239)	(0.131)	0.40	(>0.5)	(0.204)
L	1994 model: tsx, agex, sex	481.88	8	497.88	0.08	(0.264)	(0.0662)	(0.0806)	-0.86	(0.184)	-0.48	(>0.5)	0.40	(>0.5)	(0.154)

‡ Effect modification was model as a log linear function of various covariates: The following abbreviations are used: *age* - attained age; *agex* - age at exposure; *tsx* - time since exposure. If LQ is included after an effect it means that both linear and quadratic terms for this effect were included in the model.

* For models that include sex or city effects the estimates are presented as the Female:Male or Nagasaki:Hiroshima ERR (EAR) ratios. Score test P-values shown in parentheses

† The 1994 EAR model was a linear dose response model which was modified by age at exposure, time since exposure, and gender.

Table S9: Alternative models for the chronic myeloid leukemia excess risk

Dose	Effect modifiers	Deviance	Parms.	AIC	dose	dose^2	log(age)	log(age)^2	log(tsx)	log(tsx)^2	agex	agex^2	F:M ratio	N:H ratio	agex*log(age)	agex*log(tsx)	fem*log(age)	fem*log(tsx)	fem*e30
Excess relative risk (ERR) models. Dose effects are ERRs at 1 Gy at age 55 following exposure at age 30 (25 years since exposure)																			
L	age, txs, city	754.45	11	776.454	5.239	(0.439)	-1.416	(>0.5)	-1.592	(0.496)	(>0.5)	(0.416)	(0.492)	0.223	(>0.5)	(0.444)	(>0.5)	(>0.5)	(>0.5)
L-Q	age, txs, city	753.88	12	777.884	3.962	0.877	-1.374	(>0.5)	-1.624	(>0.5)	(>0.5)	(0.436)	(0.45)	0.216	(>0.5)	(0.475)	(>0.5)	(>0.5)	(>0.5)
Q	age, txs, city	761.44	11	783.442	(0.0127)	2.735	-1.250	(>0.5)	-1.811	(>0.5)	(>0.5)	(>0.5)	(0.266)	0.205	(>0.5)	(>0.5)	(>0.5)	(>0.5)	(0.488)
L	age, agex, city	760.00	11	782.001	6.933	(0.486)	-3.870	(0.0275)	(0.0197)	(0.11)	0.690	(0.0456)	(>0.5)	0.226	(0.015)	(>0.5)	(>0.5)	(0.441)	(>0.5)
L	age (LQ), agex (LQ), city	753.22	13	779.216	7.031	(0.488)	-6.221	-1.069	(>0.5)	(0.427)	1.034	-0.095	(0.439)	0.222	(>0.5)	(>0.5)	(>0.5)	(>0.5)	(>0.5)
L	tsx, agex, city	755.69	11	777.689	4.965	(0.406)	(0.242)	(0.494)	-2.105	(0.282)	-0.290	(>0.5)	(>0.5)	0.215	(>0.5)	(0.216)	(>0.5)	(>0.5)	(>0.5)
L	age, tsx, city, sex	753.98	12	777.977	4.145	(0.399)	-1.558	(>0.5)	-1.605	(0.448)	(>0.5)	(0.383)	1.581	0.222	(>0.5)	(0.468)	(>0.5)	(0.388)	(>0.5)
Excess absolute rate (EAR) model. Dose effects are excess cases per 10,000 person years at 1 Gy at age 55 following exposure at age 30 (25 years after exposure)																			
L	age, tsx, city, sex, sex*age	753.703	13	779.703	0.680	(0.374)	-0.200	(0.485)	-1.625	(0.428)	(>0.5)	(0.312)	0.836	0.226	(0.456)	(0.462)	2.297	(0.436)	(>0.5)
L-Q	age, tsx, city, sex, sex*age	752.928	14	780.928	0.479	0.135	-0.221	(0.466)	-1.671	(0.437)	(>0.5)	(0.319)	0.891	0.218	(0.454)	(>0.5)	2.391	(0.435)	(>0.5)
Q	age, tsx, city, sex, sex*age	759.155	13	785.155	(0.0407)	0.349	-0.387	(0.347)	-1.890	(>0.5)	(>0.5)	(0.344)	1.221	0.215	(0.411)	(>0.5)	2.779	(0.379)	(0.48)
L	age, agex city, sex, sex*age	759.872	13	785.872	1.029	(0.472)	-2.465	(0.0206)	(0.0162)	(0.111)	0.691	(0.0452)	0.686	0.225	(0.0124)	(>0.5)	1.357	(>0.5)	(>0.5)
L	age (LQ), agex (LQ), city, sex, sex*age	751.99	15	781.994	0.809	(0.402)	-5.739	-1.428	(0.492)	(0.451)	1.085	-0.100	0.936	0.226	(>0.5)	(0.428)	2.855	(0.413)	(0.235)
L	1994 model: tsx, sex*tsx, city	758.49	13	784.486	†	(>0.5)	(0.414)	(0.476)	-0.190	(0.269)	(0.419)	(>0.5)	2.729	†	(0.453)	(>0.5)	(0.0224)	0.136	(0.0158)

* Score test P-values shown in parentheses

† The 1994 EAR model was a linear dose response model which was modified by age at exposure, time since exposure, gender, and city. The dose response estimates were 0.224 and 0.057 for Hiroshima and Nagasaki, respectively.