

Supplementary (online only) data for:

Mortality and cancer incidence in a pooled cohort of U.S. firefighters from San Francisco, Chicago, and Philadelphia (1950-2009)

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Table S1. Cancer registry information

Cancer Registry	State	NPCR participant	SEER participant	Statewide Data Collection Began	No. of cases (%) <sup>*</sup>	No. deaths (%) <sup>†</sup>
Arizona Cancer Registry	Arizona	Yes	No	1981	105 (2.4)	157 (1.7)
California cancer Registry	California	No	Yes	1988	881 (19.7)	1477 (15.9)
Florida Cancer Data System	Florida	Yes	No	1981	301 (6.7)	532 (5.7)
Illinois State Cancer Registry	Illinois	Yes	No	1986	1783 (40.0)	2760 (29.7)
Indiana Sate Cancer Registry	Indiana	Yes	No	1987	24 (0.5)	117 (1.3)
Michigan Cancer Surveillance Program	Michigan	Yes	Yes	1985	31 (0.7)	60 (0.6)
Nevada Central Cancer Registry	Nevada	Yes	No	1995	35 (0.8)	72 (0.8)
New Jersey State Cancer Registry	New Jersey	No	Yes	1979	216 (4.8)	391 (4.2)
Oregon State Cancer Registry	Oregon	Yes	No	1996	9 (0.2)	21 (0.2)
Pennsylvania Cancer Registry	Pennsylvania	Yes	No	1985	1071 (24.0)	3196 (34.4)
Washington State Cancer Registry	Washington	Yes	Yes	1994	5 (0.1)	19 (0.2)
NA	Others	NA	NA	NA	NA	488 (5.3)

<sup>\*</sup>Includes persons with multiple primary tumors and excludes duplicate reporting ( $n=4461$ ).

<sup>†</sup>Number and percentage of deaths among cohort members with known death state ( $n=9290$ ).

NA, not applicable; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program

Table S2. Firefighter employment and vital status by gender (1950-2009).

Employment	Men		Women	
	Alive	Deceased	Alive	Deceased
Employed 1+ years	15969	11798	875	23
Employed <1 year	1031	204	90	3
Total	17000	12002	965	26

Table S3. Cause-specific standardized mortality ratios compared to the US population by fire department (1950-2009,  $n=29993$ , 858938 PYAR)

Minor ID*	Cause	All		San Francisco		Chicago		Philadelphia	
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)
1-92	All causes	12028	0.99 (0.97 to 1.01)	2074	0.84 (0.80 to 0.87)	5944	1.05 (1.02 to 1.08)	4010	1.01 (0.98 to 1.04)
1-2	Tuberculosis	12	0.35 (0.18 to 0.61)	<5	0.30 (0.04 to 1.09)	<5	0.25 (0.07 to 0.65)	6	0.51 (0.19 to 1.10)
1	Respiratory tuberculosis	11	0.35 (0.18 to 0.63)	<5	0.33 (0.04 to 1.19)	<5	0.21 (0.04 to 0.61)	6	0.55 (0.20 to 1.21)
2	Other tuberculosis	<5	0.33 (0.01 to 1.85)	0	NC	<5	0.69 (0.02 to 3.83)	0	NC
3-38	All Cancers	3285	1.14 (1.10 to 1.18)	578	1.00 (0.92 to 1.09)	1670	1.22 (1.16 to 1.28)	1037	1.11 (1.05 to 1.18)
3-6	MN buccal cavity & pharynx	94	1.40 (1.13 to 1.72)	22	1.69 (1.06 to 2.56)	41	1.28 (0.92 to 1.73)	31	1.42 (0.96 to 2.01)
3	MN lip	<5	0.80 (0.02 to 4.44)	<5	3.70 (0.09 to 20.61)	0	NC	0	NC
4	MN tongue	25	1.61 (1.04 to 2.38)	6	1.99 (0.73 to 4.33)	11	1.49 (0.74 to 2.66)	8	1.56 (0.67 to 3.08)
5	MN other buccal	25	1.43 (0.93 to 2.12)	5	1.45 (0.47 to 3.38)	8	0.97 (0.42 to 1.91)	12	2.10 (1.08 to 3.66)
6	MN pharynx	43	1.31 (0.95 to 1.77)	10	1.59 (0.76 to 2.92)	22	1.39 (0.87 to 2.10)	11	1.04 (0.52 to 1.86)
7-13	MN digestive & peritoneum	928	1.26 (1.18 to 1.34)	179	1.21 (1.04 to 1.40)	463	1.33 (1.21 to 1.46)	286	1.19 (1.06 to 1.34)
7	MN esophagus	113	1.39 (1.14 to 1.67)	23	1.45 (0.92 to 2.18)	58	1.47 (1.12 to 1.90)	32	1.22 (0.84 to 1.72)
8	MN stomach	110	1.10 (0.91 to 1.33)	25	1.23 (0.80 to 1.82)	53	1.14 (0.86 to 1.50)	32	0.97 (0.66 to 1.36)
9	MN intestine	326	1.30 (1.16 to 1.44)	56	1.09 (0.82 to 1.41)	157	1.33 (1.13 to 1.55)	113	1.38 (1.13 to 1.65)
10	MN rectum	89	1.45 (1.16 to 1.78)	20	1.59 (0.97 to 2.46)	47	1.65 (1.21 to 2.20)	22	1.08 (0.68 to 1.63)
11	MN biliary, liver, gall bladder	107	1.30 (1.06 to 1.57)	21	1.28 (0.79 to 1.96)	60	1.51 (1.15 to 1.95)	26	0.98 (0.64 to 1.44)
12	MN pancreas	168	1.13 (0.97 to 1.32)	33	1.11 (0.76 to 1.56)	81	1.15 (0.91 to 1.43)	54	1.12 (0.84 to 1.46)
13	MN peritoneum, other & unspecified	<29	1.42 (0.80 to 2.35)	<5	0.47 (0.01 to 2.60)	7	1.42 (0.57 to 2.93)	7	2.01 (0.81 to 4.15)
14-17	MN respiratory system	1096	1.10 (1.04 to 1.17)	147	0.75 (0.63 to 0.88)	594	1.24 (1.14 to 1.34)	355	1.11 (1.00 to 1.24)
14	MN larynx	<46	1.26 (0.91 to 1.69)	<5	0.44 (0.09 to 1.28)	26	1.55 (1.01 to 2.27)	15	1.32 (0.74 to 2.18)
15	MN trachea, bronchus, lung	1046	1.10 (1.04 to 1.17)	142	0.76 (0.64 to 0.89)	566	1.23 (1.13 to 1.34)	338	1.11 (0.99 to 1.23)
16	MN pleura	<5	0.81 (0.10 to 2.93)	0	NC	<5	1.71 (0.21 to 6.19)	0	NC
17	MN other respiratory sites	<5	0.66 (0.18 to 1.69)	<5	1.71 (0.21 to 6.18)	0	NC	<5	1.01 (0.12 to 3.66)
18	MN breast	8	1.39 (0.60 to 2.73)	<5	2.43 (0.50 to 7.11)	<5	1.29 (0.35 to 3.29)	<5	0.70 (0.02 to 3.92)
19-22	MN female genital organs	0	NC	0	NC	0	NC	0	NC
19	MN cervix	0	NC	0	NC	0	NC	0	NC
20	MN other parts of uterus	0	NC	0	NC	0	NC	0	NC
21	MN ovary	0	NC	0	NC	0	NC	0	NC
22	MN other female genital	0	NC	0	NC	0	NC	0	NC
23-24	MN male genital organs	286	1.07 (0.95 to 1.20)	52	0.90 (0.67 to 1.18)	152	1.23 (1.05 to 1.45)	82	0.94 (0.75 to 1.17)
23	MN prostate	282	1.09 (0.96 to 1.22)	51	0.91 (0.68 to 1.19)	152	1.28 (1.08 to 1.50)	79	0.94 (0.74 to 1.17)
24	MN other male genital	<5	0.47 (0.13 to 1.20)	<5	0.63 (0.02 to 3.50)	0	NC	<5	1.02 (0.21 to 2.99)
25-26	MN urinary	178	1.13 (0.97 to 1.31)	29	0.89 (0.60 to 1.28)	96	1.30 (1.06 to 1.59)	53	1.03 (0.77 to 1.34)

Minor ID*	Cause	All		San Francisco		Chicago		Philadelphia	
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)
25	MN kidney	94	1.29 (1.05 to 1.58)	13	0.90 (0.48 to 1.54)	56	1.62 (1.23 to 2.11)	25	1.05 (0.68 to 1.56)
26	MN bladder & other urinary	84	0.99 (0.79 to 1.22)	16	0.88 (0.50 to 1.43)	40	1.02 (0.73 to 1.39)	28	1.00 (0.67 to 1.45)
27-34	MN other & unspecified	397	1.09 (0.98 to 1.20)	89	1.23 (0.99 to 1.51)	181	1.04 (0.89 to 1.20)	127	1.06 (0.89 to 1.27)
27	MN skin	56	0.94 (0.71 to 1.22)	14	1.19 (0.65 to 1.99)	22	0.78 (0.49 to 1.19)	20	1.02 (0.62 to 1.57)
28	Mesothelioma	12	2.00 (1.03 to 3.49)	<5	2.41 (0.50 to 7.05)	8	2.73 (1.18 to 5.38)	<5	0.55 (0.01 to 3.04)
29	MN eye	<5	2.28 (0.62 to 5.84)	0	NC	<5	4.95 (1.35 to 12.67)	0	NC
30	MN brain & other nervous system	73	1.01 (0.79 to 1.27)	16	1.16 (0.66 to 1.89)	34	0.98 (0.68 to 1.37)	23	0.96 (0.61 to 1.44)
31	MN thyroid gland	<5	0.56 (0.11 to 1.62)	<5	0.93 (0.02 to 5.17)	<5	0.39 (0.01 to 2.18)	<5	0.57 (0.01 to 3.15)
32	MN bone	9	1.16 (0.53 to 2.19)	<5	0.65 (0.02 to 3.63)	6	1.66 (0.61 to 3.61)	<5	0.76 (0.09 to 2.74)
33	MN connective tissue	10	0.68 (0.32 to 1.24)	<5	0.70 (0.08 to 2.52)	<5	0.56 (0.15 to 1.44)	<5	0.84 (0.23 to 2.14)
34	MN other & unspecified sites	230	1.16 (1.02 to 1.32)	52	1.31 (0.98 to 1.72)	102	1.08 (0.88 to 1.32)	76	1.18 (0.93 to 1.48)
35-38	MN lymphatic & hematopoietic	298	1.07 (0.95 to 1.20)	57	1.01 (0.77 to 1.31)	139	1.05 (0.88 to 1.24)	102	1.12 (0.92 to 1.36)
35	Non-Hodgkin lymphoma	123	1.17 (0.97 to 1.40)	25	1.19 (0.77 to 1.75)	53	1.06 (0.80 to 1.39)	45	1.32 (0.96 to 1.77)
36	Hodgkin lymphoma	11	0.68 (0.34 to 1.22)	<5	0.66 (0.08 to 2.37)	6	0.79 (0.29 to 1.72)	<5	0.55 (0.11 to 1.60)
37	Leukemia & aleukemia	122	1.10 (0.91 to 1.31)	23	1.02 (0.65 to 1.53)	61	1.17 (0.90 to 1.50)	38	1.05 (0.74 to 1.44)
38	Multiple myeloma	42	0.89 (0.64 to 1.20)	7	0.74 (0.30 to 1.52)	19	0.84 (0.50 to 1.30)	16	1.06 (0.60 to 1.72)
39-41	Benign & unspecified neoplasms	40	1.07 (0.77 to 1.46)	8	1.06 (0.46 to 2.10)	17	0.97 (0.56 to 1.55)	15	1.23 (0.69 to 2.04)
39	Benign eye, brain, other nervous system	<5	0.92 (0.25 to 2.35)	<5	1.16 (0.03 to 6.45)	<5	0.97 (0.12 to 3.52)	<5	0.70 (0.02 to 3.88)
40	Unspecified eye, brain, other nervous system	<15	0.96 (0.52 to 1.61)	5	1.75 (0.57 to 4.09)	5	0.72 (0.23 to 1.68)	<5	0.84 (0.23 to 2.14)
41	Other benign & unspecified	<25	1.20 (0.75 to 1.82)	<5	0.53 (0.06 to 1.90)	10	1.17 (0.56 to 2.15)	10	1.69 (0.81 to 3.10)
42	Diabetes mellitus	175	0.72 (0.62 to 0.83)	17	0.35 (0.20 to 0.55)	89	0.77 (0.62 to 0.94)	69	0.89 (0.69 to 1.12)
43-46	Diseases of blood & blood-forming organs	50	1.11 (0.82 to 1.46)	11	1.16 (0.58 to 2.07)	24	1.13 (0.73 to 1.69)	15	1.04 (0.58 to 1.71)
43	Pernicious Anemia	0	NC	0	NC	0	NC	0	NC
44	Other & unspecified anemia	16	1.01 (0.58 to 1.64)	<5	0.60 (0.07 to 2.15)	10	1.34 (0.64 to 2.47)	<5	0.79 (0.21 to 2.02)
45	Coagulation & hemorrhagic conditions	7	0.77 (0.31 to 1.60)	<5	0.55 (0.01 to 3.07)	<5	0.92 (0.25 to 2.36)	<5	0.69 (0.08 to 2.50)
46	Other diseases of blood-forming organs	27	1.37 (0.91 to 2.00)	8	1.91 (0.83 to 3.77)	10	1.09 (0.52 to 2.01)	9	1.43 (0.65 to 2.72)
47-48	Mental, psychoneurotic, and personality disorders	120	0.81 (0.68 to 0.97)	20	0.65 (0.39 to 1.00)	60	0.87 (0.66 to 1.12)	40	0.85 (0.61 to 1.16)
47	Alcoholism	31	0.61 (0.41 to 0.86)	<5	0.44 (0.12 to 1.13)	19	0.74 (0.45 to 1.16)	8	0.49 (0.21 to 0.96)
48	Other mental disorders	89	0.92 (0.74 to 1.14)	16	0.73 (0.42 to 1.19)	41	0.94 (0.67 to 1.28)	32	1.04 (0.71 to 1.47)

Minor ID*	Cause	All		San Francisco		Chicago		Philadelphia	
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)
49-50	Nervous system disorders	187	0.80 (0.69 to 0.93)	43	0.86 (0.62 to 1.15)	82	0.76 (0.61 to 0.95)	62	0.83 (0.63 to 1.06)
49	Multiple sclerosis	<10	0.57 (0.21 to 1.23)	0	NC	5	0.99 (0.32 to 2.30)	<5	0.28 (0.01 to 1.58)
50	Other nervous system diseases	181	0.82 (0.70 to 0.94)	43	0.89 (0.64 to 1.20)	77	0.75 (0.59 to 0.94)	61	0.86 (0.65 to 1.10)
51-55	Diseases of the heart	4289	0.99 (0.96 to 1.02)	720	0.80 (0.74 to 0.86)	2124	1.06 (1.02 to 1.11)	1445	1.01 (0.95 to 1.06)
51	Rheumatic heart disease	51	0.89 (0.66 to 1.17)	6	0.54 (0.20 to 1.17)	24	0.90 (0.58 to 1.35)	21	1.08 (0.67 to 1.65)
52	Ischemic heart disease	3619	1.01 (0.98 to 1.04)	598	0.80 (0.74 to 0.87)	1812	1.10 (1.05 to 1.15)	1209	1.02 (0.96 to 1.08)
53	Chronic Diseases of endocardium	56	0.99 (0.75 to 1.29)	15	1.22 (0.68 to 2.02)	25	0.97 (0.63 to 1.44)	16	0.87 (0.49 to 1.41)
54	Hypertension w/heart disease	111	0.84 (0.69 to 1.02)	24	0.89 (0.57 to 1.32)	54	0.89 (0.67 to 1.16)	33	0.76 (0.52 to 1.06)
55	Other heart disease	452	0.88 (0.81 to 0.97)	77	0.72 (0.57 to 0.90)	209	0.88 (0.76 to 1.00)	166	1.00 (0.86 to 1.17)
56-58	Other diseases circulatory system	967	0.91 (0.85 to 0.97)	201	0.88 (0.76 to 1.01)	439	0.91 (0.83 to 1.00)	327	0.93 (0.83 to 1.04)
56	Hypertension w/o heart disease	46	0.85 (0.62 to 1.13)	10	0.88 (0.42 to 1.61)	25	0.98 (0.64 to 1.45)	11	0.63 (0.32 to 1.13)
57	Cerebrovascular disease	636	0.91 (0.84 to 0.98)	131	0.86 (0.72 to 1.02)	298	0.95 (0.84 to 1.06)	207	0.89 (0.77 to 1.02)
58	Diseases of the arteries, Veins, and pulmonary circulation	285	0.93 (0.82 to 1.04)	60	0.91 (0.70 to 1.18)	116	0.82 (0.68 to 0.99)	109	1.07 (0.88 to 1.30)
59-64	Diseases of the respiratory system	796	0.80 (0.74 to 0.86)	137	0.65 (0.54 to 0.76)	411	0.89 (0.81 to 0.98)	248	0.77 (0.67 to 0.87)
59	Acute respiratory infections except influenza and pneumonia	0	NC	0	NC	0	NC	0	NC
60	Influenza	<5	0.22 (0.03 to 0.81)	<5	0.51 (0.01 to 2.83)	<5	0.26 (0.01 to 1.43)	0	NC
61	Pneumonia	269	0.90 (0.79 to 1.01)	55	0.84 (0.64 to 1.10)	129	0.95 (0.79 to 1.12)	85	0.86 (0.69 to 1.06)
62	Chronic obstructive pulmonary diseases	367	0.72 (0.65 to 0.80)	57	0.53 (0.40 to 0.69)	206	0.87 (0.75 to 0.99)	104	0.63 (0.52 to 0.77)
63	Asthma	<10	0.36 (0.14 to 0.74)	<5	0.51 (0.06 to 1.84)	5	0.55 (0.18 to 1.27)	0	NC
64	Pneumoconiosis & other respiratory diseases	151	0.97 (0.82 to 1.14)	22	0.67 (0.42 to 1.01)	70	0.97 (0.76 to 1.23)	59	1.18 (0.90 to 1.52)
65-68	Diseases of the digestive system	572	1.13 (1.04 to 1.23)	110	1.11 (0.91 to 1.34)	277	1.16 (1.02 to 1.30)	185	1.12 (0.96 to 1.29)
65	Diseases of the stomach & duodenum	64	1.16 (0.89 to 1.48)	12	1.06 (0.54 to 1.84)	29	1.15 (0.77 to 1.66)	23	1.23 (0.78 to 1.85)
66	Hernia & intestinal obstruction	<23	0.69 (0.41 to 1.07)	<5	0.17 (0.00 to 0.93)	8	0.64 (0.28 to 1.27)	10	1.08 (0.52 to 1.99)
67	Cirrhosis & other chronic liver disease	299	1.26 (1.12 to 1.41)	65	1.47 (1.13 to 1.87)	144	1.25 (1.05 to 1.47)	90	1.15 (0.93 to 1.42)

Minor ID*	Cause	All		San Francisco		Chicago		Philadelphia	
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)
68	Other diseases digestive system	190	1.04 (0.89 to 1.19)	32	0.85 (0.58 to 1.21)	96	1.11 (0.90 to 1.36)	62	1.04 (0.79 to 1.33)
69-77	Diseases of the genitourinary system	201	1.00 (0.87 to 1.15)	36	0.84 (0.59 to 1.16)	91	0.98 (0.79 to 1.21)	74	1.14 (0.89 to 1.43)
69	Acute glomerulonephritis nephrotic syndrome and acute renal failure	32	1.56 (1.07 to 2.20)	7	1.61 (0.65 to 3.31)	14	1.46 (0.80 to 2.46)	11	1.67 (0.83 to 2.99)
70	Chronic and unspecified nephritis and renal failure & other renal sclerosis	91	0.86 (0.69 to 1.05)	9	0.40 (0.18 to 0.77)	48	0.96 (0.71 to 1.28)	34	1.00 (0.70 to 1.40)
71	Kidney infection	9	0.75 (0.34 to 1.42)	<5	1.14 (0.24 to 3.34)	<5	0.77 (0.21 to 1.96)	<5	0.48 (0.06 to 1.72)
72	Urinary system calculi	<5	1.29 (0.35 to 3.30)	<5	1.51 (0.04 to 8.43)	<5	0.73 (0.02 to 4.06)	<5	1.86 (0.23 to 6.73)
73	Prostate hyperplasia	11	1.27 (0.63 to 2.28)	<5	1.84 (0.50 to 4.71)	5	1.50 (0.49 to 3.51)	<5	0.64 (0.08 to 2.30)
74	Other diseases of male genital organs	<5	0.34 (0.01 to 1.87)	0	NC	0	NC	<5	0.99 (0.03 to 5.53)
75	Diseases of breast	0	NC	0	NC	0	NC	0	NC
76	diseases female genital organs	0	NC	0	NC	0	NC	0	NC
77	Other genitourinary diseases	53	1.12 (0.84 to 1.46)	12	1.18 (0.61 to 2.05)	19	0.87 (0.52 to 1.36)	22	1.44 (0.90 to 2.18)
78-79	diseases of skin & subcutaneous tissue	13	1.18 (0.63 to 2.02)	<5	1.77 (0.48 to 4.53)	<5	0.77 (0.21 to 1.97)	5	1.41 (0.46 to 3.29)
78	Skin & subcutaneous infections	5	1.21 (0.39 to 2.83)	<5	2.35 (0.28 to 8.48)	<5	1.03 (0.12 to 3.71)	<5	0.75 (0.02 to 4.18)
79	Other diseases skin & subcutaneous tissue	8	1.17 (0.50 to 2.30)	<5	1.42 (0.17 to 5.13)	<5	0.62 (0.07 to 2.23)	<5	1.81 (0.49 to 4.63)
80-82	diseases musculoskeletal & connective tissue	15	0.53 (0.30 to 0.88)	<5	0.35 (0.04 to 1.25)	7	0.53 (0.21 to 1.09)	6	0.66 (0.24 to 1.45)
80	Arthritis & spondylitis	<5	0.18 (0.02 to 0.65)	0	NC	0	NC	<5	0.55 (0.07 to 1.98)
81	Osteomyelitis & periostitis	<5	0.91 (0.19 to 2.67)	0	NC	<5	1.27 (0.15 to 4.60)	<5	0.97 (0.02 to 5.41)
82	Other diseases musculoskeletal	10	0.73 (0.35 to 1.35)	<5	0.72 (0.09 to 2.61)	5	0.76 (0.25 to 1.78)	<5	0.69 (0.14 to 2.01)
83	Symptoms & ill-defined conditions	161	1.31 (1.11 to 1.53)	<5	0.08 (0.01 to 0.30)	54	0.92 (0.69 to 1.19)	105	2.62 (2.14 to 3.17)
84-88	Accidents	524	0.86 (0.79 to 0.94)	87	0.78 (0.62 to 0.96)	289	0.99 (0.88 to 1.11)	148	0.73 (0.62 to 0.86)
84	Transportation accidents	160	0.56 (0.48 to 0.65)	29	0.57 (0.38 to 0.82)	89	0.65 (0.52 to 0.80)	42	0.43 (0.31 to 0.58)
85	Accidental poisoning	45	0.88 (0.64 to 1.18)	6	0.70 (0.26 to 1.51)	26	0.98 (0.64 to 1.43)	13	0.82 (0.43 to 1.39)
86	Accidental falls	113	1.31 (1.08 to 1.58)	27	1.49 (0.98 to 2.17)	62	1.57 (1.20 to 2.01)	24	0.84 (0.54 to 1.26)
87	Other accidents	197	1.17 (1.01 to 1.34)	24	0.77 (0.50 to 1.15)	109	1.34 (1.10 to 1.61)	64	1.14 (0.88 to 1.46)
88	Medical causes	9	0.63 (0.29 to 1.20)	<5	0.35 (0.01 to 1.95)	<5	0.44 (0.09 to 1.29)	5	1.08 (0.35 to 2.52)

Minor ID*	Cause	All		San Francisco		Chicago		Philadelphia	
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)
89-91	Violence	251	0.78 (0.69 to 0.89)	57	1.00 (0.76 to 1.30)	120	0.75 (0.63 to 0.90)	74	0.71 (0.55 to 0.89)
89	Suicide	193	0.87 (0.75 to 1.00)	50	1.24 (0.92 to 1.63)	86	0.81 (0.65 to 1.00)	57	0.76 (0.58 to 0.99)
90	Homicide	58	0.59 (0.45 to 0.76)	7	0.43 (0.17 to 0.88)	34	0.65 (0.45 to 0.91)	17	0.57 (0.33 to 0.91)
91	Terrorism	0	NC	0	NC	0	NC	0	NC
92	Other & unspecified causes	370	1.15 (1.04 to 1.27)	39	0.63 (0.45 to 0.86)	182	1.14 (0.98 to 1.32)	149	1.49 (1.26 to 1.75)

\*Minor cause-of-death category in NIOSH Life Table Analysis System (LTAS) 92-cause rate file: <http://www.cdc.gov/niosh/ltras/rates.html>.

MN, malignancy; NC, not calculated; Obs, observed; SMR, standardized mortality ratio.



Table S4. Cancer-specific standardized incidence ratios compared to the US population by fire department (1985-2009,  $n=24453$ , 403152 PYAR)\*

Minor ID <sup>†</sup>	Cause	All		San Francisco		Chicago		Philadelphia	
		Obs	SIR (95% CI)	Obs	SIR (95% CI)	Obs	SIR (95% CI)	Obs	SIR (95% CI)
1-41	All Cancers	4461	1.09 (1.06 to 1.12)	855	1.14 (1.06 to 1.22)	2186	1.09 (1.04 to 1.13)	1420	1.07 (1.01 to 1.12)
1-4	MN buccal cavity & pharynx	174	1.39 (1.19 to 1.62)	43	1.96 (1.42 to 2.64)	81	1.32 (1.05 to 1.64)	50	1.20 (0.89 to 1.58)
1	MN lip	<20	1.11 (0.65 to 1.78)	10	3.71 (1.78 to 6.82)	5	0.68 (0.22 to 1.58)	<5	0.38 (0.05 to 1.38)
2	MN tongue	52	1.74 (1.30 to 2.28)	9	1.70 (0.78 to 3.23)	23	1.58 (1.00 to 2.38)	20	1.97 (1.20 to 3.04)
3	MN other buccal	46	1.24 (0.91 to 1.65)	11	1.67 (0.83 to 2.99)	25	1.37 (0.89 to 2.03)	10	0.81 (0.39 to 1.49)
4	MN pharynx	59	1.39 (1.06 to 1.79)	13	1.77 (0.94 to 3.02)	28	1.33 (0.88 to 1.92)	18	1.29 (0.76 to 2.03)
5-6	MN colon & rectum	537	1.18 (1.08 to 1.28)	100	1.20 (0.98 to 1.46)	267	1.20 (1.06 to 1.35)	170	1.14 (0.97 to 1.32)
5	MN large intestine	381	1.21 (1.09 to 1.34)	72	1.24 (0.97 to 1.56)	186	1.21 (1.04 to 1.40)	123	1.19 (0.99 to 1.42)
6	MN rectum	156	1.11 (0.94 to 1.30)	28	1.12 (0.74 to 1.61)	81	1.17 (0.93 to 1.46)	47	1.02 (0.75 to 1.35)
7-12	MN digestive other & peritoneum	393	1.16 (1.05 to 1.28)	69	1.11 (0.87 to 1.41)	200	1.20 (1.04 to 1.37)	124	1.13 (0.94 to 1.35)
7	MN esophagus	90	1.62 (1.31 to 2.00)	15	1.49 (0.83 to 2.45)	49	1.79 (1.33 to 2.37)	26	1.44 (0.94 to 2.12)
8	MN stomach	93	1.15 (0.93 to 1.40)	12	0.82 (0.42 to 1.43)	50	1.24 (0.92 to 1.64)	31	1.18 (0.80 to 1.68)
9	MN small intestine	<18	1.15 (0.67 to 1.85)	<5	1.49 (0.41 to 3.82)	5	0.69 (0.22 to 1.61)	8	1.66 (0.72 to 3.28)
10	MN biliary, liver, gall bladder	85	1.10 (0.88 to 1.36)	16	1.12 (0.64 to 1.82)	47	1.22 (0.89 to 1.62)	22	0.89 (0.56 to 1.35)
11	MN pancreas	90	0.96 (0.77 to 1.18)	19	1.10 (0.66 to 1.72)	43	0.94 (0.68 to 1.27)	28	0.92 (0.61 to 1.32)
12	MN peritoneum, other & unspecified	<20	1.10 (0.65 to 1.74)	<5	1.01 (0.21 to 2.96)	6	0.74 (0.27 to 1.62)	9	1.70 (0.78 to 3.23)
13-16	MN respiratory & Intrathoracic	813	1.16 (1.08 to 1.24)	91	0.72 (0.58 to 0.88)	463	1.33 (1.21 to 1.46)	259	1.14 (1.00 to 1.29)
13	MN larynx	84	1.50 (1.19 to 1.85)	10	1.02 (0.49 to 1.88)	42	1.51 (1.08 to 2.03)	32	1.73 (1.18 to 2.44)
14	MN trachea, bronchus, lung	716	1.12 (1.04 to 1.21)	81	0.70 (0.56 to 0.87)	409	1.30 (1.17 to 1.43)	226	1.09 (0.96 to 1.25)
15	MN pleura	0	NC	0	NC	0	NC	0	NC
16	MN other respiratory & intrathoracic	<17	1.37 (0.73 to 2.34)	0	NC	12	2.55 (1.32 to 4.45)	<5	0.32 (0.01 to 1.80)
17	MN breast	26	1.26 (0.82 to 1.85)	6	1.23 (0.45 to 2.67)	14	1.19 (0.65 to 1.99)	6	1.53 (0.56 to 3.32)
18-21	MN female genital organs	<5	0.62 (0.13 to 1.81)	<5	0.77 (0.02 to 4.28)	<5	0.66 (0.08 to 2.40)	0	NC
18	MN cervix uteri	<5	1.20 (0.15 to 4.33)	<5	2.06 (0.05 to 11.49)	<5	1.02 (0.03 to 5.67)	0	NC
19	MN other & unspecified parts of uterus	<5	0.56 (0.01 to 3.11)	0	NC	<5	0.86 (0.02 to 4.81)	0	NC
20	MN ovary, fallopian tube, & broad ligament	0	NC	0	NC	0	NC	0	NC
21	MN other female genital organs	0	NC	0	NC	0	NC	0	NC
22-24	MN male genital organs	1278	1.02 (0.97 to 1.08)	278	1.21 (1.07 to 1.36)	602	0.98 (0.91 to 1.07)	398	0.98 (0.89 to 1.09)
22	MN prostate	1261	1.03 (0.98 to 1.09)	276	1.22 (1.08 to 1.37)	592	0.99 (0.91 to 1.07)	393	0.99 (0.90 to 1.10)
23	MN testes	<18	0.75 (0.42 to 1.24)	<5	0.74 (0.09 to 2.67)	8	0.76 (0.33 to 1.50)	5	0.75 (0.24 to 1.75)
24	MN other & unspecified male genital organs	<5	0.26 (0.03 to 0.93)	0	NC	<5	0.53 (0.06 to 1.92)	0	NC
25-26	MN urinary organs	482	1.17 (1.06 to 1.27)	89	1.15 (0.93 to 1.42)	234	1.17 (1.02 to 1.32)	159	1.17 (1.00 to 1.37)
25	MN kidney	166	1.27 (1.09 to 1.48)	26	1.10 (0.72 to 1.61)	83	1.30 (1.04 to 1.61)	57	1.33 (1.00 to 1.72)

Minor ID <sup>†</sup>	Cause	All		San Francisco		Chicago		Philadelphia	
		Obs	SIR (95% CI)	Obs	SIR (95% CI)	Obs	SIR (95% CI)	Obs	SIR (95% CI)
26	MN bladder & other urinary organs	316	1.12 (1.00 to 1.25)	63	1.18 (0.91 to 1.51)	151	1.10 (0.93 to 1.29)	102	1.10 (0.90 to 1.33)
27-28	MN thyroid & other endocrine glands	28	0.91 (0.60 to 1.31)	<5	0.72 (0.20 to 1.84)	15	0.98 (0.55 to 1.61)	9	0.91 (0.42 to 1.72)
27	MN thyroid gland	25	0.87 (0.56 to 1.28)	<5	0.57 (0.12 to 1.68)	13	0.90 (0.48 to 1.55)	9	0.97 (0.44 to 1.85)
28	MN other endocrine glands	<5	1.50 (0.31 to 4.39)	<5	2.90 (0.07 to 16.18)	<5	2.03 (0.25 to 7.32)	0	NC
29-35	MN other solid cancers	275	0.97 (0.86 to 1.09)	85	1.69 (1.35 to 2.09)	104	0.76 (0.62 to 0.92)	86	0.90 (0.72 to 1.11)
29	MN bone	<13	2.62 (1.35 to 4.57)	0	NC	8	3.49 (1.51 to 6.87)	<5	2.66 (0.72 to 6.81)
30	MN melanoma (skin)	141	0.87 (0.73 to 1.03)	56	1.89 (1.43 to 2.46)	44	0.56 (0.41 to 0.76)	41	0.75 (0.54 to 1.02)
31	Kaposi sarcoma	<5	0.17 (0.05 to 0.43)	<5	0.30 (0.01 to 1.69)	<5	0.08 (0.00 to 0.47)	<5	0.23 (0.03 to 0.83)
32	MN mesothelioma	35	2.29 (1.60 to 3.19)	6	2.05 (0.75 to 4.47)	20	2.71 (1.65 to 4.18)	9	1.82 (0.83 to 3.46)
33	MN connective tissue	22	1.07 (0.67 to 1.62)	<5	1.06 (0.29 to 2.72)	10	0.99 (0.47 to 1.82)	8	1.19 (0.51 to 2.34)
34	MN brain & other nervous system	51	1.02 (0.76 to 1.34)	17	1.95 (1.14 to 3.12)	13	0.53 (0.28 to 0.91)	21	1.25 (0.77 to 1.91)
35	MN eye	<18	1.45 (0.69 to 2.66)	<5	0.81 (0.02 to 4.53)	8	2.44 (1.05 to 4.80)	<5	0.44 (0.01 to 2.44)
36-40	MN lymphohematopoietic tissue	345	0.94 (0.84 to 1.04)	68	1.00 (0.78 to 1.27)	154	0.85 (0.72 to 1.00)	123	1.02 (0.85 to 1.22)
36	Hodgkin lymphoma	<17	0.96 (0.54 to 1.59)	6	2.36 (0.87 to 5.15)	6	0.76 (0.28 to 1.65)	<5	0.58 (0.12 to 1.70)
37	Non-Hodgkin lymphoma	169	0.99 (0.84 to 1.15)	28	0.90 (0.60 to 1.30)	79	0.94 (0.75 to 1.18)	62	1.10 (0.84 to 1.41)
38	Multiple myeloma	36	0.72 (0.50 to 0.99)	9	0.97 (0.44 to 1.84)	16	0.65 (0.37 to 1.05)	11	0.68 (0.34 to 1.21)
39	Leukemia & aleukemia	100	0.94 (0.77 to 1.15)	22	1.12 (0.70 to 1.69)	43	0.83 (0.60 to 1.12)	35	1.01 (0.70 to 1.40)
40	Other lymphohematopoietic neoplasms	<27	0.97 (0.63 to 1.43)	<5	0.56 (0.12 to 1.64)	10	0.79 (0.38 to 1.45)	12	1.54 (0.79 to 2.68)
41	MN III-specified & residual	107	1.04 (0.86 to 1.26)	21	1.10 (0.68 to 1.68)	50	1.00 (0.75 to 1.32)	36	1.07 (0.75 to 1.48)

\*Analysis of all occurrences of invasive cancer (i.e., multiple-cancer approach).

<sup>†</sup> Minor cause-of-death category in Table S4 of this appendix.

MN, malignancy; NC, not calculated; Obs, observed; SIR, standardized incidence ratio.

Table S5. Recode from ICD-O-3 codes reported by cancer incidence registries to diagnostic minor codes used in NIOSH LTAS\*.

Major Category	Minor ID	Minor Category	ICD-10 Codes	ICD-O-3 Site Codes	ICD-O-3 Histology Codes
MN of buccal cavity and pharynx	1	MN of lip	C00	C000-C009	All excluding 9140, 9050-9055, and 9590-9989
	2	MN of tongue	C01, C02	C019-C029	
	3	MN of other buccal cavity	C03-C08	C039-C069, C079-C089	
	4	MN of pharynx	C09-C14	C090- C119, C129-C148	
MN of colon and rectum	5	MN of colon	C18	C180-C189	
	6	MN of rectum	C19, C20	C199, C209	
MN of other digestive organs and peritoneum	7	MN of esophagus	C15	C150- C159	
	8	MN of stomach	C16	C160-C169	
	9	MN of small intestine	C17	C170-C179	
	10	MN of biliary, liver, gall bladder	C22-C24	C220, C221, C239-C249	
	11	MN of pancreas	C25	C250-C259	
	12	MN of anus, peritoneum, other, and unspecified digestive	C21, C26, C48	C210-C212, C218, C260, C268, C269, C422, C480-C482, C488	
MN of respiratory and Intrathoracic organs	13	MN of larynx	C32	C320-C329	
	14	MN of trachea, bronchus, and lung	C33, C34	C339-C349	
	15	MN of pleura	C38.4	C384	
	16	MN of other respiratory and intrathoracic organs	C30, C31, C37, C38.0-C38.3, C38.8, C39	C300,C301, C310-C319, C379, C380-C383, C388, C390, C398, C399	
MN of breast	17	MN of breast	C50	C500-C509	
MN of female genital organs	18	MN of cervix uteri	C53	C530-C539	
	19	MN of other and unspecified parts of uterus	C54, C55, C58	C540-C549, C559, C589	
	20	MN of ovary, fallopian tube, and broad ligament	C56, 57.0-C57.4, C57.8	C569-C574, C578	

Major Category	Minor ID	Minor Category	ICD-10 Codes	ICD-O-3 Site Codes	ICD-O-3 Histology Codes
	21	MN of other and unspecified female genital organs	C51, C52, C57.7, C57.9	C510-C519, C529, C577, C579	
MN of male genital organs	22	MN of prostate	C61	C619	
	23	MN of testes	C62	C620-C629	
	24	MN of other and unspecified male genital organs	C60, C63	C600-C609, C630-C639	
MN of urinary organs	25	MN of kidney	C64-C66	C649, C659, C669	
	26	MN of bladder and other urinary organs	C67, C68, D09.0 <sup>†</sup>	C670-C689	
MN of thyroid and other endocrine glands	27	MN of thyroid gland	C73	C739	
	28	MN of other endocrine glands	C74, C75	C740-C749, C750-C759	
MN of other solid cancers	29	MN of bone	C40, C41	C400-C419	
	30	Malignant melanoma of skin	C43	C440-C449	8720-8790
	31	Kaposi sarcoma	C46	Not used	9140
	32	Mesothelioma	C45	Not used	9050-9055
	33	MN of connective tissue	C49	C490-C499	All excluding 9140, 9050-9055, and 9590-9989
	34	MN brain and other parts of nervous system	C47, C70-C72	C470-C479, C700-C729	
	35	MN eye	C69	C690-C699	
	Malignant neoplasms of lymphatic and hematopoietic tissue	36	Hodgkin lymphoma	C81	Not used
37		Non-Hodgkin lymphoma	C82-C85, C88.0, C88.3, C91.4, C96.0-C96.3, C96.7	Not used	9590, 9591, 9596, 9670, 9671, 9673, 9675, 9678-9680, 9684, 9687, 9688, 9689-9691, 9695, 9698-9702, 9705, 9708, 9709, 9712, 9714-9719, 9724-9729, 9735, 9737, 9738, 9740, 9750, 9754-9759, 9761, 9764, 9940
38		Multiple myeloma	C90	Not used	9731-9734
39		Leukemia and aleukemia	C91.0-C91.3, C91.5, C91.7, C91.9, C92-C95	Not used	9742, 9800, 9801, 9805, 9820, 9823, 9826, 9827, 9831-9837, 9840, 9860, 9861, 9863, 9866, 9867, 9870-9876, 9891, 9895-9897, 9910, 9920, 9930, 9931, 9945, 9946, 9948, 9963

Major Category	Minor ID	Minor Category	ICD-10 Codes	ICD-O-3 Site Codes	ICD-O-3 Histology Codes
	40	Other lymphatic and hematopoietic neoplasms	C88.2, C88.7, C88.9, C96.9, D45, D46.1-D46.4, D46.7, D46.9, D47.1, D47.3, D47.7	Not used	9751, 9760, 9762, 9950, 9960-9962, 9970, 9975, 9980, 9982-9987, 9989
Ill-specified and residual	41	MN of Ill-specified and residual sites	C44, C76, C77, C80, C97	C440-C449	All excluding 8720-8790, 9140, 9050-9055, and 9590-9989
				C760-C768, C809, C420-C424, C770-C779	All excluding 9140, 9050-9055, and 9590-9989

\*Results in Table 2 of the main manuscript differ slightly from Table S3 due to classification adjustment made to better align cancer incidence diagnoses with mortality results in Table 2. Specifically, Table 2 differs from this recode by including ICD-10 codes C21 with MN rectum, C96.9 with NHL, and C88.7 and C88.9 with multiple myeloma.

†Urinary bladder incidence cases originally coded *in situ* (Behavior=2) were recoded to invasive (Behavior=3) per SEER protocol.

ICD-O-3, International Classification of Diseases for Oncology, 3rd Edition; ICD-10, International Classification of Diseases, 10th Revision; MN, malignancy; SEER, Surveillance, Epidemiology, and End Results Program

Table S6. Heterogeneity in standardized mortality ratios across fire departments with U.S. population referent (1950-2009).

Minor ID*	Underlying Cause	All fire departments†		San Francisco		Chicago		Philadelphia		Heterogeneity‡ LRT p-value
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	
7	MN esophagus	113	1.39 (1.15 to 1.67)	23	1.45 (0.92 to 2.18)	58	1.47 (1.12 to 1.90)	32	1.22 (0.84 to 1.72)	1.00
8	MN stomach	110	1.10 (0.91 to 1.33)	25	1.23 (0.80 to 1.82)	53	1.14 (0.86 to 1.50)	32	0.97 (0.66 to 1.36)	1.00
9	MN intestine	326	1.30 (1.16 to 1.44)	56	1.09 (0.82 to 1.41)	157	1.33 (1.13 to 1.55)	113	1.38 (1.13 to 1.65)	1.00
10	MN rectum	89	1.45 (1.16 to 1.80)	20	1.59 (0.97 to 2.46)	47	1.65 (1.21 to 2.20)	22	1.08 (0.68 to 1.63)	0.48
15	MN lung	1046	1.02 (0.81 to 1.29)	142	0.76 (0.64 to 0.89)	566	1.23 (1.13 to 1.34)	338	1.11 (0.99 to 1.23)	<0.01
23	MN prostate	282	1.05 (0.87 to 1.27)	51	0.91 (0.68 to 1.19)	152	1.28 (1.08 to 1.50)	79	0.94 (0.74 to 1.17)	0.08
25	MN kidney	94	1.23 (0.90 to 1.67)	13	0.90 (0.48 to 1.54)	56	1.62 (1.23 to 2.11)	25	1.05 (0.68 to 1.56)	0.17
26	MN bladder	84	0.99 (0.80 to 1.22)	16	0.88 (0.50 to 1.43)	40	1.02 (0.73 to 1.39)	28	1.00 (0.67 to 1.45)	1.00
30	MN brain	73	1.01 (0.80 to 1.27)	16	1.16 (0.66 to 1.89)	34	0.98 (0.68 to 1.37)	23	0.96 (0.61 to 1.44)	1.00
35	NHL	123	1.17 (0.98 to 1.40)	25	1.19 (0.77 to 1.75)	53	1.06 (0.80 to 1.39)	45	1.32 (0.96 to 1.77)	1.00
37	Leukemia	122	1.10 (0.92 to 1.32)	23	1.02 (0.65 to 1.53)	61	1.17 (0.90 to 1.50)	38	1.05 (0.74 to 1.44)	1.00
38	Multiple myeloma	42	0.89 (0.66 to 1.20)	7	0.74 (0.30 to 1.52)	19	0.84 (0.50 to 1.30)	16	1.06 (0.60 to 1.72)	1.00
62	COPD	367	0.68 (0.53 to 0.85)	57	0.53 (0.40 to 0.69)	206	0.87 (0.75 to 0.99)	104	0.63 (0.52 to 0.77)	<0.01

\* Minor cause-of-death category in NIOSH Life Table Analysis System (LTAS) 92-cause rate file: <http://www.cdc.gov/niosh/ltras/rates.html>. Reporting restricted to 20 or more total cases.

† Results from Poisson mixed model that adjusts for fire department-specific effects as a random variable.

‡ Results of testing against the null model (i.e., no between-department variance).

COPD, chronic obstructive pulmonary disease; ICD-10, International Classification of Diseases, 10th Revision; LRT, likelihood ratio test; MN, malignancy; NC, Not calculated; NHL, non-Hodgkin lymphoma; Obs, observed; SMR, standardized mortality ratio.

Table S7. Heterogeneity in standardized incidence ratios by department compared to the US population for cancers of *a priori* interest (1985-2009).

Minor ID*	Cause	All departments <sup>†</sup>		San Francisco		Chicago		Philadelphia		Heterogeneity <sup>‡</sup> LRT p-value
		Obs	SIR (95% CI)	Obs	SIR (95% CI)	Obs	SIR (95% CI)	Obs	SIR (95% CI)	
5	MN large intestine	381	1.21 (1.09 to 1.34)	72	1.24 (0.97 to 1.56)	186	1.21 (1.04 to 1.40)	123	1.19 (0.99 to 1.42)	1.00
6	MN rectum	156	1.11 (0.95 to 1.30)	28	1.12 (0.74 to 1.61)	81	1.17 (0.93 to 1.46)	47	1.02 (0.75 to 1.35)	1.00
7	MN esophagus	90	1.62 (1.32 to 1.99)	15	1.49 (0.83 to 2.45)	49	1.79 (1.33 to 2.37)	26	1.44 (0.94 to 2.12)	1.00
8	MN stomach	93	1.15 (0.94 to 1.40)	12	0.82 (0.42 to 1.43)	50	1.24 (0.92 to 1.64)	31	1.18 (0.80 to 1.68)	1.00
14	MN lung	716	1.01 (0.76 to 1.35)	81	0.70 (0.56 to 0.87)	409	1.30 (1.17 to 1.43)	226	1.10 (0.96 to 1.25)	<0.001
17	MN breast	26	1.26 (0.86 to 1.85)	6	1.23 (0.45 to 2.67)	14	1.19 (0.65 to 1.99)	6	1.53 (0.56 to 3.32)	1.00
22	MN prostate	1261	1.05 (0.95 to 1.17)	276	1.22 (1.08 to 1.37)	592	0.99 (0.91 to 1.07)	393	0.99 (0.90 to 1.10)	0.078
25	MN kidney	166	1.27 (1.09 to 1.48)	26	1.10 (0.72 to 1.61)	83	1.30 (1.04 to 1.61)	57	1.33 (1.00 to 1.72)	1.00
26	MN bladder	316	1.11 (1.00 to 1.25)	63	1.18 (0.91 to 1.51)	151	1.10 (0.93 to 1.29)	102	1.10 (0.90 to 1.33)	1.00
34	MN brain	51	1.07 (0.59 to 1.95)	17	1.95 (1.14 to 3.12)	13	0.53 (0.28 to 0.91)	21	1.25 (0.77 to 1.91)	0.007
37	NHL	169	0.99 (0.85 to 1.15)	28	0.90 (0.60 to 1.30)	79	0.94 (0.75 to 1.18)	62	1.10 (0.84 to 1.41)	1.00
38	Multiple myeloma	36	0.72 (0.52 to 0.99)	9	0.97 (0.44 to 1.84)	16	0.65 (0.37 to 1.05)	11	0.68 (0.34 to 1.21)	1.00
39	Leukemia	100	0.94 (0.78 to 1.15)	22	1.12 (0.70 to 1.69)	43	0.83 (0.60 to 1.12)	35	1.01 (0.70 to 1.40)	1.00

\* Minor cause shown in Table S4 of this appendix. Reporting restricted to 20 or more total cases.

<sup>†</sup>Results from Poisson mixed model that adjusts for department-specific effects as a random variable.

<sup>‡</sup>Results of testing against the null model (i.e., no between-department variance).

COPD, chronic obstructive pulmonary disease; LRT, likelihood ratio test; MN, malignancy; NHL, non-Hodgkin lymphoma; Obs, observed; SMR, standardized mortality ratio.

Table S8. Standardized mortality ratios using State mortality rates for causes of death of *a priori* interest (1950-2009).

Minor ID*	Underlying Cause	All departments <sup>†</sup>		San Francisco (California rates)		Chicago (Illinois rates)		Philadelphia (Pennsylvania rates)		Heterogeneity <sup>‡</sup> LRT p-value
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	
7	MN esophagus	113	1.28 (1.06 to 1.54)	23	1.57 (1.00 to 2.36)	58	1.32 (1.00 to 1.71)	32	1.07 (0.73 to 1.52)	1.00
8	MN stomach	110	1.05 (0.87 to 1.26)	25	1.20 (0.78 to 1.77)	53	1.10 (0.82 to 1.43)	32	0.90 (0.61 to 1.27)	1.00
9	MN intestine	326	1.19 (1.07 to 1.33)	56	1.22 (0.92 to 1.59)	157	1.17 (1.00 to 1.37)	113	1.19 (0.98 to 1.44)	1.00
10	MN rectum	89	1.30 (1.01 to 1.68)	20	1.67 (1.02 to 2.59)	47	1.45 (1.07 to 1.93)	22	0.92 (0.58 to 1.40)	0.32
15	MN lung	1046	1.06 (0.92 to 1.23)	142	0.87 (0.73 to 1.02)	566	1.20 (1.10 to 1.30)	338	1.10 (0.99 to 1.22)	0.02
23	MN prostate	282	1.04 (0.86 to 1.26)	51	0.90 (0.67 to 1.19)	152	1.26 (1.07 to 1.48)	79	0.92 (0.73 to 1.15)	0.08
25	MN kidney	94	1.24 (0.96 to 1.61)	13	0.97 (0.51 to 1.66)	56	1.51 (1.14 to 1.96)	25	1.06 (0.68 to 1.56)	0.37
26	MN bladder	84	0.94 (0.76 to 1.17)	16	0.91 (0.52 to 1.47)	40	0.98 (0.70 to 1.33)	28	0.92 (0.61 to 1.33)	1.00
30	MN brain	73	1.05 (0.83 to 1.32)	16	1.13 (0.64 to 1.83)	34	1.01 (0.70 to 1.42)	23	1.05 (0.66 to 1.57)	1.00
35	NHL	123	1.11 (0.93 to 1.33)	25	1.17 (0.76 to 1.73)	53	0.99 (0.74 to 1.30)	45	1.25 (0.91 to 1.68)	1.00
37	Leukemia	122	1.07 (0.90 to 1.28)	23	1.07 (0.68 to 1.60)	61	1.10 (0.84 to 1.42)	38	1.03 (0.73 to 1.41)	1.00
38	Multiple myeloma	42	0.91 (0.67 to 1.23)	7	0.75 (0.30 to 1.55)	19	0.86 (0.52 to 1.34)	16	1.07 (0.61 to 1.74)	1.00
62	COPD	367	0.71 (0.55 to 0.93)	57	0.54 (0.41 to 0.69)	206	0.93 (0.81 to 1.07)	104	0.69 (0.56 to 0.84)	<0.01

\* Minor cause-of-death category in NIOSH Life Table Analysis System (LTAS) 92-cause rate file: <http://www.cdc.gov/niosh/ltras/rates.html>. Reporting restricted to 20 or more total cases.

<sup>†</sup> Results from Poisson mixed model that adjusts for department-specific effects as a random variable.

<sup>‡</sup> Results of testing against the null model (i.e., no between-department variance).

COPD, chronic obstructive pulmonary disease; LRT, likelihood ratio test; MN, malignancy; NC, not calculated; NHL, non-Hodgkin lymphoma; Obs, observed; SMR, standardized mortality ratio.



Table S9. Standardized mortality ratios by hire type, with U.S. population referent (1950-2009).

Minor ID*	Underlying Cause	All hires		Hired on or after 1950 (incident hires only)			
		employed 1+ years		All		Employed 1+ years	
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)
1-92	All causes	11821	0.99 (0.97 to 1.01)	4441	0.91 (0.89 to 0.94)	4236	0.90 (0.88 to 0.93)
3-38	All cancers	3231	1.14 (1.10 to 1.18)	1454	1.12 (1.07 to 1.18)	1400	1.12 (1.06 to 1.18)
7	MN esophagus	111	1.39 (1.14 to 1.67)	67	1.51 (1.17 to 1.92)	65	1.52 (1.17 to 1.94)
8	MN stomach	109	1.11 (0.91 to 1.34)	45	1.29 (0.94 to 1.73)	44	1.31 (0.95 to 1.76)
9	MN intestine	322	1.30 (1.16 to 1.45)	120	1.18 (0.98 to 1.41)	116	1.18 (0.98 to 1.42)
10	MN rectum	88	1.45 (1.17 to 1.79)	36	1.56 (1.09 to 2.15)	35	1.57 (1.09 to 2.19)
15	MN lung	1028	1.10 (1.03 to 1.17)	476	1.05 (0.96 to 1.15)	458	1.05 (0.95 to 1.15)
18	MN breast	7	1.25 (0.50 to 2.57)	6	1.68 (0.62 to 3.67)	5	1.47 (0.48 to 3.43)
23	MN prostate	278	1.09 (0.96 to 1.22)	95	1.18 (0.96 to 1.45)	91	1.18 (0.95 to 1.45)
24	MN other male genital organs	<5	0.48 (0.13 to 1.23)	<5	0.42 (0.05 to 1.52)	<5	0.43 (0.05 to 1.57)
25	MN kidney	91	1.28 (1.03 to 1.57)	53	1.46 (1.10 to 1.92)	50	1.43 (1.06 to 1.89)
26	MN bladder& other urinary	84	1.00 (0.80 to 1.24)	27	0.89 (0.59 to 1.30)	27	0.93 (0.61 to 1.35)
30	MN brain & other nervous	73	1.03 (0.81 to 1.29)	36	0.90 (0.63 to 1.25)	36	0.94 (0.66 to 1.30)
35	NHL	120	1.16 (0.96 to 1.39)	56	1.06 (0.80 to 1.38)	53	1.04 (0.78 to 1.37)
37	Leukemia	121	1.11 (0.92 to 1.33)	55	1.10 (0.83 to 1.43)	54	1.12 (0.84 to 1.46)
38	Multiple myeloma	42	0.90 (0.65 to 1.22)	17	0.76 (0.44 to 1.22)	17	0.79 (0.46 to 1.26)
62	COPD	361	0.72 (0.65 to 0.80)	145	0.75 (0.63 to 0.88)	139	0.75 (0.63 to 0.88)

\* Minor cause-of-death category in NIOSH Life Table Analysis System (LTAS) 92-cause rate file: <http://www.cdc.gov/niosh/ltras/rates.html>.

COPD, chronic obstructive pulmonary disease; ICD-10, International Classification of Diseases, 10th Revision; MN, malignancy; NHL, non-Hodgkin lymphoma; Obs, observed; SMR, standardized mortality ratio.

Table S10. Heterogeneity in standardized mortality ratios by age compared to the US population for causes of death of *a priori* interest (1950-2009).

Minor ID*	Underlying Cause	All Ages <sup>†</sup>		Age 65-85+		Age 17-64		Heterogeneity <sup>‡</sup> LRT p-value
		Obs	SMR (95% CI)	Obs	SMR (95% CI)	Obs	SMR (95% CI)	
7	MN esophagus	113	1.39 (1.15 to 1.67)	62	1.36 (1.05 to 1.75)	51	1.41 (1.05 to 1.86)	1.00
8	MN stomach	110	1.02 (0.76 to 1.37)	74	1.33 (1.05 to 1.68)	36	0.81 (0.57 to 1.12)	0.07
9	MN intestine	326	1.23 (1.03 to 1.48)	231	1.42 (1.24 to 1.61)	95	1.07 (0.87 to 1.31)	0.08
10	MN rectum	89	1.45 (1.18 to 1.78)	51	1.49 (1.11 to 1.96)	38	1.40 (0.99 to 1.92)	1.00
15	MN lung	1046	1.09 (1.01 to 1.18)	662	1.17 (1.09 to 1.27)	384	0.99 (0.90 to 1.10)	0.29
23	MN prostate	282	1.09 (0.97 to 1.22)	245	1.08 (0.95 to 1.23)	37	1.10 (0.77 to 1.51)	1.00
25	MN kidney	94	1.29 (1.06 to 1.58)	46	1.15 (0.84 to 1.53)	48	1.47 (1.09 to 1.95)	1.00
26	MN bladder	84	0.97 (0.74 to 1.26)	65	1.01 (0.78 to 1.29)	19	0.90 (0.54 to 1.41)	0.35
30	MN brain	73	1.01 (0.80 to 1.27)	34	1.20 (0.83 to 1.67)	39	0.89 (0.63 to 1.21)	1.00
35	NHL	123	1.15 (0.90 to 1.46)	86	1.37 (1.09 to 1.69)	37	0.88 (0.62 to 1.21)	0.39
37	Leukemia	122	1.10 (0.92 to 1.31)	81	1.17 (0.93 to 1.46)	41	0.98 (0.70 to 1.33)	1.00
38	Multiple myeloma	42	0.89 (0.66 to 1.20)	29	0.93 (0.63 to 1.34)	13	0.80 (0.42 to 1.37)	1.00
62	COPD	367	0.70 (0.59 to 0.82)	313	0.77 (0.69 to 0.86)	54	0.53 (0.40 to 0.70)	0.06

\* Minor cause-of-death category in NIOSH Life Table Analysis System (LTAS) 92-cause rate file: <http://www.cdc.gov/niosh/ltras/rates.html>. Reporting restricted to 20 or more total cases.

<sup>†</sup>Results from Poisson mixed model that adjusts for age-specific effects as a random variable.

<sup>‡</sup>Results of testing against the null model (i.e., no between-age group variance). Age defined as all ages in 5-year periods.

COPD, chronic obstructive pulmonary disease; LRT, likelihood ratio test; NC, not calculated; MN, malignancy; NHL, non-Hodgkin lymphoma; Obs, observed; SMR, standardized mortality ratio.

Table S11. Heterogeneity in standardized incidence ratios by age compared to the US population for cancers of *a priori* interest (1985-2009).

Minor ID*	Underlying Cause	All Ages <sup>†</sup>		Age 65-85+		Age 17-64		Heterogeneity <sup>‡</sup> LRT p-value
		Obs	SIR (95% CI)	Obs	SIR (95% CI)	Obs	SIR (95% CI)	
5	MN large intestine	381	1.21 (1.09 to 1.34)	269	1.20 (1.06 to 1.35)	112	1.23 (1.01 to 1.48)	1.00
6	MN rectum	156	1.11 (0.95 to 1.30)	97	1.12 (0.91 to 1.37)	59	1.10 (0.83 to 1.41)	1.00
7	MN esophagus	90	1.60 (1.27 to 2.03)	55	1.59 (1.20 to 2.07)	35	1.68 (1.17 to 2.34)	0.40
8	MN stomach	93	1.15 (0.94 to 1.40)	62	1.15 (0.88 to 1.48)	31	1.14 (0.77 to 1.61)	1.00
14	MN lung	716	1.12 (1.05 to 1.21)	494	1.13 (1.03 to 1.23)	222	1.12 (0.98 to 1.28)	1.00
17	MN breast	26	1.26 (0.86 to 1.85)	<5	0.53 (0.11 to 1.56)	23	1.53 (0.97 to 2.30)	1.00
22	MN prostate	1261	1.10 (0.95 to 1.28)	835	0.96 (0.90 to 1.03)	426	1.21 (1.10 to 1.33)	<0.001
25	MN kidney	166	1.27 (1.09 to 1.48)	87	1.17 (0.94 to 1.44)	79	1.41 (1.12 to 1.76)	1.00
26	MN bladder	316	1.11 (0.90 to 1.36)	219	1.04 (0.91 to 1.19)	97	1.33 (1.08 to 1.62)	0.002
34	MN brain	51	1.02 (0.77 to 1.34)	25	1.04 (0.67 to 1.54)	26	1.00 (0.65 to 1.46)	1.00
37	NHL	169	0.98 (0.82 to 1.17)	107	1.10 (0.90 to 1.33)	62	0.84 (0.64 to 1.07)	0.351
38	Multiple myeloma	36	0.72 (0.52 to 0.99)	26	0.77 (0.50 to 1.13)	10	0.60 (0.29 to 1.11)	1.00
39	Leukemia	100	0.94 (0.78 to 1.15)	61	0.86 (0.66 to 1.10)	39	1.12 (0.80 to 1.53)	1.00

\* Minor cause shown in Table S4 of this appendix. Reporting restricted to 20 or more total cases.

<sup>†</sup> Results from Poisson mixed model that adjusts for age-specific effects as a random variable.

<sup>‡</sup> Results of testing against the null model (i.e., no between-age group variance). Age defined as all ages in 5-year periods.

LRT, likelihood ratio test; MN, malignancy; NHL, non-Hodgkin lymphoma; Obs, observed; SIR, standardized incidence ratio.

Table S12. Standardized mortality ratios with censoring at age  $\geq 85$  for causes of death of *a priori* interest (1950-2009), US population referent.

Minor ID*	Underlying Cause	All ages		Age <85	
		Obs	SMR (95% CI)	Obs	SMR (95% CI)
7	MN esophagus	113	1.39 (1.14 to 1.67)	108	1.38 (1.13 to 1.66)
8	MN stomach	110	1.10 (0.91 to 1.33)	102	1.07 (0.87 to 1.30)
9	MN intestine	326	1.30 (1.16 to 1.44)	301	1.29 (1.15 to 1.44)
10	MN rectum)	89	1.45 (1.16 to 1.78)	82	1.40 (1.12 to 1.74)
15	MN lung	1046	1.10 (1.04 to 1.17)	1001	1.09 (1.03 to 1.16)
18	MN breast	8	1.39 (0.60 to 2.73)	7	1.27 (0.51 to 2.62)
23	MN prostate	282	1.09 (0.96 to 1.22)	235	1.08 (0.95 to 1.23)
24	MN other male genital	<5	0.47 (0.13 to 1.20)	<5	0.48 (0.13 to 1.24)
25	MN kidney	94	1.29 (1.05 to 1.58)	91	1.32 (1.06 to 1.62)
26	MN bladder	84	0.99 (0.79 to 1.22)	75	1.00 (0.78 to 1.25)
30	MN brain	73	1.01 (0.79 to 1.27)	71	1.00 (0.78 to 1.26)
35	NHL	123	1.17 (0.97 to 1.40)	113	1.15 (0.95 to 1.39)
37	Leukemia	122	1.10 (0.91 to 1.31)	116	1.13 (0.93 to 1.36)
38	Multiple myeloma	42	0.89 (0.64 to 1.20)	39	0.88 (0.63 to 1.20)
62	COPD	367	0.72 (0.65 to 0.80)	321	0.71 (0.64 to 0.79)

\* Minor cause-of-death category in NIOSH Life Table Analysis System (LTAS) 92-cause rate file:

<http://www.cdc.gov/niosh/ltas/rates.html>.

COPD, chronic obstructive pulmonary disease; LRT, likelihood ratio test; MN, malignancy; NHL, non-Hodgkin lymphoma; Obs, observed; SMR, standardized mortality ratio.