CHAPTER 55

Breast-Cancers, Females, 1940-1990

• Table 55-A provides the summary on Fractional Causation by medical radiation, by decades starting with 1940. Column A shows that age-adjusted National Breast Cancer MortRates, per 100,000 women, have barely changed since 1940 (although incidence rates have risen dramatically). Breast Cancer MortRates by separate age-bands are shown, by decades from 1950 through 1990, in Chapter 4 (Box 3). For some age-groups, the trend has been up --- and for others, the trend has been down.

• Although National Breast Cancer MortRates are steady in the 1940-1988 period, they are not steady everywhere. Box 1 shows that MortRates FELL in the TopTrio of Census Divisions, while simultaneously RISING in the LowTrio of Census Divisions. The facts in Box 1 mean that a carcinogenic co-actor which can contribute to female MortRates, from Breast Cancers, is operating more strongly in the LowTrio than in the TopTrio (Chapter 48, Part 5b). We must match the Census Divisions for this co-actor, regardless of its identity. We believe its identity is cigarette smoke.

Table 55-A
Breast-Cancers, Females: Fractional Causation by Medical Radiation over Time

Year	Col.A Natl MR	Col.B Frac.C	Col.C R-Sq	Col.D X-Coef	Col.E StdErr	Col.F Coef/SE	Col.G Source
1940	23.3	~100%	0.9153	0.1906	0.0219	8.6965	Chap.8
1950	22.5	93%	0.9098	0.1572	0.0187	8.4021	Tab 55-B
1960	22.9	90%	0.9043	0.1569	0.0193	8.1309	Tab 55-C
1970	23.1	87%	0.8875	0.1467	0.0197	7.4317	Tab 55-D
1980	22.6	85%	0.8717	0.1335	0.0194	6.8964	Tab 55-E
1990	23.1	83%	0.8924	0.1187	0.0156	7.6213	Tab 55-F

Box 1, Chap. 55
Breast Cancer, Females: Post-1940 Change in MortRates by Census Trios

1960 vs. 1940, by Trios: Col.D expresses change by ratios. Col.F expresses change by subtraction.
1990 vs. 1940, by Trios: Col.I expresses change by ratios. Col.K expresses change by subtraction.
MRs change inversely with PP. In high-PP Trio, rates decline. In Low-PP Trio, rates grow.

	Col.A 1940 MortRate Tab 8-A	Col.B 1960 MortRate Tab 8-A	Col.C Ratio Col.B /Col.A	Col.D Input from Col.C	Col.E Diff: Col.B minus A	Col.F Input from Col.E	Col.G 1990 MortRate Tab 8-A	Col.H Ratio Col.G /Col.A	Col.I Input from Col.H	Col.J Diff: Col.G minus A	Col.K Input from Col.J
Pacif	26.7	23.3	0.873	Avg Chg	-3.4	Avg Chg	22.7	0.850	Avg Chg	-4.0	Avg Chg
NewE	28.8	25.9	0.899	TopTrio	-2.9	TopTrio	24.3	0.844	TopTrio	-4.5	TopTrio
MidAtl	27.8	26.8	0.964	0.912	-1.0	-2.4	25.8	0.928	0.874	-2.0	-3.5
WNoCen	22.6	22.8	1.009	Avg Chg	0.2	Avg Chg	22.6	1.000	Avg Chg	0.0	Avg Chg
ENoCen	24.3	24.3	1.000	MidTrio	0.0	MidTrio	24.1	0.992	MidTrio	-0.2	MidTrio
Mtn	18.6	20.3	1.091	1.033	1.7	0.6	21.0	1.129	1.040	2.4	0.7
WSoCen	15.1	17.8	1.179	Avg Chg	2.7	Avg Chg	20.8	1.377	Avg Chg	5.7	Avg Chg
ESoCen	15.1	17.6	1.166	LowTrio	2.5	LowTrio	21.4	1.417	LowTrio	6.3	LowTrio
SoAtl	18.3	19.4	1.060	1.135	1.1	2.1	22.6	1.235	1.343	4.3	5.4

Box 2, Chap. 55
Breast-Cancers, Females: Calculation of Adjustment Factor

This adjustment is discussed fully in Chapter 49.

• Part 1: Calculate average population-weighted MortRate for the combined TopTrio Census Divs.

Census Div.	Col.A 1940 MR Tab 8-A	Col.B 1940 Pop'n Tab 3-B	Col.C 1940 Popn /45,710,039	Col.D Col.A * Col.C
Pacific	26.7	9,733,262	0.2129	5.69
NewEng	28.8	8,437,290	0.1846	5.32
Mid-Atl	27.8	27,539,487	0.6025	16.75
1940		Sum TopTrio 45,710,039	Sum 1.0000	TopTrio 27.750

Census Div.	Col.A 1950 MR Tab 8-A	Col.B 1950 Pop'n Tab 3-B	Col.C 1950 Popn /53,964,513	Col.D Col.A * Col.C
Pacific	23.8	14,486,527	0.2684	6.39
NewEng	25.8	9,314,453	0.1726	4.45
Mid-Atl	26.5	30,163,533	0.5590	14.81
1950		Sum TopTrio 53,964,513	Sum 1.0000	TopTrio 25.654

Census Div.	Col.A 1960 MR Tab 8-A	Col.B 1960 Pop'n Tab 3-B	Col.C 1960 Popn /65,875,863	Col.D Col.A * Col.C
Pacific	23.3	21,198,044	0.3218	7.50
NewEng	25.9	10,509,367	0.1595	4.13
Mid-Atl	26.8	34,168,452	0.5187	13.90
1960		Sum TopTrio 65,875,863	Sum 1.0000	TopTrio 25.530

Census Div.	Col.A 1970 MR Tab 8-A	Col.B 1970 Pop'n Tab 3-B	Col.C 1970 Popn /75,017,000	Col.D Col.A * Col.C
Pacific	22.3	26,087,000	0.3477	7.75
NewEng	25.3	11,781,000	0.1570	3.97
Mid-Atl	26.4	37,149,000	0.4952	13.07
1970		Sum TopTrio 75,017,000	Sum 1.0000	TopTrio 24.801

Census Div.	Col.A 1980 MR Tab 8-A	Col.B 1980 Pop'n Tab 3-B	Col.C 1980 Popn /80,615,000	Col.D Col.A * Col.C
Pacific	21.2	31,523,000	0.3910	8.29
NewEng	24.7	12,322,000	0.1528	3.78
Mid-Atl	25.9	36,770,000	0.4561	11.81
1980		Sum TopTrio 80,615,000	Sum 1.0000	TopTrio 23.879

Census Div.	Col.A 1990 MR Tab 8-A	Col.B 1990 Pop'n Tab 3-B	Col.C 1990 Popn /88,495,000	Col.D Col.A * Col.C
Pacific	22.7	37,837,000	0.4276	9.71
NewEng	24.3	12,998,000	0.1469	3.57
Mid-Atl	25.8	37,660,000	0.4256	10.98
1990		Sum TopTrio 88,495,000	Sum 1.0000	TopTrio 24.254

• Part 2: Take ratios of these TopTrio MortRates, with 1940 as the denominator of each ratio.
Col.D modifies Col.C by separate PhysPop adjustments for MidTrio and LowTrio Census Divisions.

	Col.A TopTrio Mean MR	Col.B 1940 TopTrio Mean MR	Col.C = Col.A / Col.B	Col.D ppAdju Tab 47-B	Col.E = Col.C * Col.D	BREAST CANCERS. Females.
				MidTrio		
1950	25.654	27.750	0.924	0.99	0.92	= MidTrio Adjustment Factor, 1950
1960	25.530	27.750	0.920	0.97	0.89	= MidTrio Adjustment Factor, 1960
1970	24.801	27.750	0.894	0.95	0.85	= MidTrio Adjustment Factor, 1970
1980	23.879	27.750	0.860	0.94	0.81	= MidTrio Adjustment Factor, 1980
1990	24.254	27.750	0.874	0.94	0.82	= MidTrio Adjustment Factor, 1990
				LowTrio		
1950	25.654	27.750	0.924	1.00	0.92	= LowTrio Adjustment Factor, 1950
1960	25.530	27.750	0.920	1.01	0.93	= LowTrio Adjustment Factor, 1960
1970	24.801	27.750	0.894	1.02	0.91	= LowTrio Adjustment Factor, 1970
1980	23.879	27.750	0.860	1.04	0.89	= LowTrio Adjustment Factor, 1980
1990	24.254	27.750	0.874	1.07	0.94	= LowTrio Adjustment Factor, 1990

Table 55-B

Breast Cancers, Females: Fractional Causation in 1950

Part 1.

Calculation of the 6 Adjusted MortRates (Col.F) and the National Adjusted MortRate (Col.G).

The last six entries in Part 1, Col.F, are the products of (Col.D * Col.E), as discussed in Chap. 49.

Trio-Sequence	Col.A 1950 PopFrac Tab 3-B	Col.B 1950 Obs MR Tab 8-A	Col.C A * B	Col.D 1940 MR Mid,Low Tab 8-A	Col.E AdjuFact Bx2,Pt2 Col.E	Col.F 1950 Adju MortRates	Col.G A * F
Pacific	0.0961	23.8	2.287			23.8	2.287
New England	0.0618	25.8	1.594			25.8	1.594
Mid-Atlantic	0.2002	26.5	5.305			26.5	5.305
WestNoCentral	0.0933	22.6	2.109	22.6	0.92	20.79	1.940
EastNoCentral	0.2017	23.5	4.740	24.3	0.92	22.36	4.509
Mountain	0.0337	18.8	0.634	18.6	0.92	17.11	0.577
WestSoCentral	0.0965	16.6	1.602	15.1	0.92	13.89	1.341
EastSoCentral	0.0762	16.6	1.265	15.1	0.92	13.89	1.059
SouthAtlantic	0.1406	18.4	2.587	18.3	0.92	16.84	2.367
		Sum =	22.1				Sum =
1950 Observed MR from Table 8-B			22.5	1950 Natl Adjusted MR =			20.9790

Part 2.

Trio-Seq.	Col.A Mean1940 thru1950 Adju MRs PPs from Tab 47-A x'	Col.B 1950 MRs from Col.F Part 1 y	Col.C Breast Cancers, Females: 1950 Adjusted MortRates regressed on Mean 1940 thru 1950 PPs Regression Output:		Col.D 1940 PPs from Table 3-A (TrioSeq) x''	Col.E Breast Cancers, Females: 1950 Adjusted MortRates regressed on 1940 PhysPops Regression Output:	
Pac	154.16	23.8	Constant	0.1607	159.72	Constant	-0.0134
NewEng	162.03	25.8	Std Err of Y Est	1.5622	161.55	Std Err of Y Est	1.5088
MidAtl	169.24	26.5	R Squared	0.9098	169.76	R Squared	0.9159
WNoCen	121.60	20.79	No. of Observation	9	123.14	No. of Observation	9
ENoCen	128.53	22.36	Degrees of Freedom	7	133.36	Degrees of Freedom	7
Mtn	119.64	17.11			119.89		
WSoCen	102.64	13.89	X Coefficient(s)	0.1572	103.94	X Coefficient(s)	0.1564
ESoCen	84.44	13.89	Std Err of Coef.	0.0187	85.83	Std Err of Coef.	0.0179
SoAtl	99.91	16.84	XCoef / S.E. =	8.4021	100.74	XCoef / S.E.	8.7284

Part 3-A.

Calculation of Fractional Causation from Averaged PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.C) = 0.1607

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 20.9790) minus Nonradiation rate (0.1607) = 20.8182

3. 1950 Fractional Causation is radiation rate (20.8182) divided by OBSERVED Natl MR Part 1,Col.C= 22.5 = 0.93

Part 3-B.

Calculation of Fractional Causation from 1940 PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.E) = Negative 0.0

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 20.9790) minus Nonradiation rate (0.0) = 20.9790

3. 1950 Fractional Causation is radiation rate (20.9790) divided by OBSERVED Natl MR Part 1, Col.C= 22.5 = 0.93

Table 55-C

Breast Cancers, Females: Fractional Causation in 1960

Part 1.

Calculation of the 6 Adjusted MortRates (Col.F) and the National Adjusted MortRate (Col.G).

The last six entries in Part 1, Col.F, are the products of (Col.D * Col.E), as discussed in Chap. 49.

Trio-Sequence	Col.A 1960 PopFrac Tab 3-B	Col.B 1960 Obs MR Tab 8-A	Col.C A * B	Col.D 1940 MR Mid,Low Tab 8-A	Col.E AdjuFact Bx2,Pt2 Col.E	Col.F 1960 Adju MortRates	Col.G A * F
Pacific	0.1182	23.3	2.754			23.3	2.754
New England	0.0586	25.9	1.518			25.9	1.518
Mid-Atlantic	0.1905	26.8	5.105			26.8	5.105
WestNoCentral	0.0858	22.8	1.956	22.6	0.89	20.11	1.726
EastNoCentral	0.2020	24.3	4.909	24.3	0.89	21.63	4.369
Mountain	0.0382	20.3	0.775	18.6	0.89	16.55	0.632
WestSoCentral	0.0945	17.8	1.682	15.1	0.93	14.04	1.327
EastSoCentral	0.0672	17.6	1.183	15.1	0.93	14.04	0.944
SouthAtlantic	0.1448	19.4	2.809	18.3	0.93	17.02	2.464
		Sum =	22.7				Sum =
1960 Observed MR from Table 8-B			22.9	1960 Natl Adjusted MR =			20.8391

Part 2.

Trio-Seq.	Col.A Mean1940 thru1960 PPs from Tab 47-A x'	Col.B 1960 Adju MRs from Col.F Part 1 y	Col.C Breast Cancers, Females: 1960 Adjusted MortRates regressed on Mean 1940 thru 1960 PPs		Col.D 1940 PPs from Table 3-A (TrioSeq) x''	Col.E Breast Cancers, Females: 1960 Adjusted MortRates regressed on 1940 PhysPops	
			Regression Output:			Regression Output:	
Pac	155.69	23.3	Constant	0.1508	159.72	Constant	-0.0073
NewEng	162.81	25.9	Std Err of Y Est	1.5963	161.55	Std Err of Y Est	1.5108
MidAtl	167.04	26.8	R Squared	0.9043	169.76	R Squared	0.9142
WNoCen	118.15	20.11	No. of Observation	9	123.14	No. of Observation	9
ENoCen	123.87	21.63	Degrees of Freedom	7	133.36	Degrees of Freedom	7
Mtn	117.40	16.55			119.89		
WSoCen	102.31	14.04	X Coefficient(s)	0.1569	103.94	X Coefficient(s)	0.1550
ESoCen	85.63	14.04	Std Err of Coef.	0.0193	85.83	Std Err of Coef.	0.0179
SoAtl	101.72	17.02	XCoef / S.E. =	8.1309	100.74	XCoef / S.E.	8.6381

Part 3-A.

Calculation of Fractional Causation from Averaged PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.C) = 0.1508

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 20.8391) minus Nonradiation rate (0.1508) = 20.6883

3. 1960 Fractional Causation is radiation rate (20.6883) divided by OBSERVED Natl MR Part 1,Col.C= 22.9 = 0.90

Part 3-B.

Calculation of Fractional Causation from 1940 PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.E) = Negative 0.0

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 20.8391) minus Nonradiation rate (0.0) = 20.8391

3. 1960 Fractional Causation is radiation rate (20.8391) divided by OBSERVED Natl MR Part 1, Col.C= 22.9 = 0.91

Table 55-E

Breast Cancers, Females: Fractional Causation in 1980

Part 1.

Calculation of the 6 Adjusted MortRates (Col.F) and the National Adjusted MortRate (Col.G).
The last six entries in Part 1, Col.F, are the products of (Col.D * Col.E), as discussed in Chap. 49.

Trio-Sequence	Col.A 1980 PopFrac Tab 3-B	Col.B 1980 Obs MR Tab 8-A	Col.C A * B	Col.D 1940 MR Mid,Low Tab 8-A	Col.E AdjuFact Bx2,Pt2 Col.E	Col.F 1980 Adju MortRates	Col.G A * F
Pacific	0.1398	21.2	2.964			21.2	2.964
New England	0.0546	24.7	1.349			24.7	1.349
Mid-Atlantic	0.1630	25.9	4.222			25.9	4.222
WestNoCentral	0.0759	21.7	1.647	22.6	0.81	18.31	1.389
EastNoCentral	0.1846	24.0	4.430	24.3	0.81	19.68	3.633
Mountain	0.0502	20.3	1.019	18.6	0.81	15.07	0.756
WestSoCentral	0.1049	18.9	1.983	15.1	0.89	13.44	1.410
EastSoCentral	0.0646	19.6	1.266	15.1	0.89	13.44	0.868
SouthAtlantic	0.1624	21.0	3.410	18.3	0.89	16.29	2.645
		Sum =	22.3				Sum =
1980 Observed MR from Table 8-B			22.6	1980 Natl Adjusted MR =			19.2362

Part 2.

Trio-Seq.	Col.A Mean1940 thru1980 PPs from Tab 47-A x'	Col.B 1980 Adju MRs from Col.F Part 1 y
Pac	177.35	21.2
NewEng	185.86	24.7
MidAtl	186.11	25.9
WNoCen	128.82	18.31
ENoCen	133.71	19.68
Mtn	133.45	15.07
WSoCen	114.66	13.44
ESoCen	99.46	13.44
SoAtl	124.62	16.29

Col.C — Breast Cancers, Females: 1980 Adjusted MortRates regressed on Mean 1940 thru 1980 PPs

Regression Output:	
Constant	-0.3834
Std Err of Y Est	1.7630
R Squared	0.8717
No. of Observation	9
Degrees of Freedom	7
X Coefficient(s)	0.1335
Std Err of Coef.	0.0194
XCoef / S.E. =	6.8964

Col.D — 1940 PPs from Table 3-A (TrioSeq) x''

159.72
161.55
169.76
123.14
133.36
119.89
103.94
85.83
100.74

Col.E — Breast Cancers, Females: 1980 Adjusted MortRates regressed on 1940 PhysPops

Regression Output:	
Constant	-0.0638
Std Err of Y Est	1.6597
R Squared	0.8863
No. of Observation	9
Degrees of Freedom	7
X Coefficient(s)	0.1456
Std Err of Coef.	0.0197
XCoef / S.E.	7.3870

Part 3-A.
Calculation of Fractional Causation from Averaged PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.C) = Negative 0.0

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 19.2362) minus Nonradiation rate (0.0) = 19.2362

3. 1980 Fractional Causation is radiation rate (19.2362) divided by OBSERVED Natl MR Part 1,Col.C= 22.6 = 0.85

Part 3-B.
Calculation of Fractional Causation from 1940 PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.E) = Negative 0.0

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 19.2362) minus Nonradiation rate (0.0) = 19.2362

3. 1980 Fractional Causation is radiation rate (19.2362) divided by OBSERVED Natl MR Part 1, Col.C= 22.6 = 0.85

Table 55-F

Breast Cancers, Females: Fractional Causation in 1990

Part 1.

Calculation of the 6 Adjusted MortRates (Col.F) and the National Adjusted MortRate (Col.G).

The last six entries in Part 1, Col.F, are the products of (Col.D * Col.E), as discussed in Chap. 49.

Trio-Sequence	Col.A 1990 PopFrac Tab 3-B	Col.B 1990 Obs MR Tab 8-A	Col.C A * B	Col.D 1940 MR Mid,Low Tab 8-A	Col.E AdjuFact Bx2,Pt2 Col.E	Col.F 1990 Adju MortRates	Col.G A * F
Pacific	0.1535	22.7	3.484			22.7	3.484
New England	0.0527	24.3	1.281			24.3	1.281
Mid-Atlantic	0.1527	25.8	3.940			25.8	3.940
WestNoCentral	0.0721	22.6	1.629	22.6	0.82	18.53	1.336
EastNoCentral	0.1713	24.1	4.128	24.3	0.82	19.93	3.413
Mountain	0.0543	21.0	1.140	18.6	0.82	15.25	0.828
WestSoCentral	0.1087	20.8	2.261	15.1	0.94	14.19	1.543
EastSoCentral	0.0621	21.4	1.329	15.1	0.94	14.19	0.881
SouthAtlantic	0.1725	22.6	3.899	18.3	0.94	17.20	2.967
		Sum =	23.1				Sum =
1990 Observed MR from Table 8-B			23.1	1990 Natl Adjusted MR =			19.6741

Part 2.

Trio-Seq.	Col.A Mean1940 thru1990 PPs from Tab 47-A x'	Col.B 1990 Adju MRs from Col.F Part 1 y
Pac	191.97	22.7
NewEng	208.20	24.3
MidAtl	204.72	25.8
WNoCen	141.14	18.53
ENoCen	146.19	19.93
Mtn	145.91	15.25
WSoCen	126.28	14.19
ESoCen	113.28	14.19
SoAtl	142.93	17.20

Col.C

Breast Cancers, Females:
1990 Adjusted MortRates
regressed on
Mean 1940 thru 1990 PPs

Regression Output:	
Constant	0.3898
Std Err of Y Est	1.5304
R Squared	0.8924
No. of Observation	9
Degrees of Freedom	7
X Coefficient(s)	0.1187
Std Err of Coef.	0.0156
XCoef / S.E. =	7.6213

Col.D

1940
PPs from
Table 3-A
(TrioSeq)
x''

159.72
161.55
169.76
123.14
133.36
119.89
103.94
85.83
100.74

Col.E

Breast Cancers, Females:
1990 Adjusted MortRates
regressed on
1940 PhysPops

Regression Output:	
Constant	1.2779
Std Err of Y Est	1.5142
R Squared	0.8947
No. of Observation	9
Degrees of Freedom	7
X Coefficient(s)	0.1387
Std Err of Coef.	0.0180
XCoef / S.E.	7.7128

Part 3-A.
Calculation of Fractional Causation
from Averaged PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.C) = 0.3898

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 19.6741) minus Nonradiation rate (0.3898) = 19.2843

3. 1990 Fractional Causation is radiation rate (19.2843) divided by OBSERVED Natl MR Part 1,Col.C= 23.1 = 0.83

Part 3-B.
Calculation of Fractional Causation
from 1940 PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.E) = 1.2779

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 19.6741) minus Nonradiation rate (1.2779) = 18.3962

3. 1990 Fractional Causation is radiation rate (18.3962) divided by OBSERVED Natl MR Part 1, Col.C= 23.1 = 0.80