CHAPTER 64

Ischemic Heart Disease, Males, 1950–1993

• Table 64-A, Column A, shows a pattern of National MortRates unlike any of the patterns for cancer. The National MortRate from Ischemic Heart Disease rose until 1963 (a year not shown in our Table 40-B), and then began its dramatic decline.

• Box 1 reveals that these events occurred unevenly across the Census Divisions, however. The facts in Box 1 show that a co-actor (smoking), which can contribute to male MortRates from Ischemic Heart Disease, is operating more strongly in the LowTrio than in the TopTrio (Chapter 48, Part 5b). We must match the Census Divisions for smoking.

• Unlike the smoking adjustment for cancer, which is based on 1940 MortRates, the adjustment for IHD has to be based on 1950 MortRates --- which have been impacted by an extra decade of the inverse relationship between smoking and PhysPop. If we had been able to evaluate the 1940 dose-response between PhysPop and male IHD MortRates, the 1940 Fractional Causation by medical radiation would probably have been higher than 79%, because the impact of extra smoking in the LowTrio would probably have been less severe in 1940 than 1950. This conjecture is consistent with the finding that, for females, the 1950 Fractional Causation by medical radiation of IHD mortality is higher than for males --- and females had a history of less intense smoking (Chapter 48, Part 3).

Table 64-A
Ischemic Heart Disease, Males: 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	No data available						No data
1950	256.4	79%	0.9475	1.4852	0.1321	11.2446	Chap. 40
1960	306.5	74%	0.8733	1.7259	0.2485	6.9463	Tab 64-B
1970	259.7	72%	0.8344	1.3710	0.2309	5.9387	Tab 64-C
1980	212.8	70%	0.7714	1.0117	0.2081	4.8608	Tab 64-D
1993	131.0	63%	0.7279	0.4969	0.1148	4.3271	Tab 64-E

Box 1, Chap. 64
Ischemic Heart Disease, Males: Post-1940 Change in MortRates by Census Trios

1960 vs. 1950, by Trios: Col.D expresses change by ratios. Col.F expresses change by subtraction.
1993 vs. 1950, by Trios: Col.I expresses change by ratios. Col.K expresses change by subtraction.
MRs change inversely with PP. High-PP Trio has lowest growth-factor. Low-PP Trio has highest growth-factor.

	Col.A 1950 MortRate Tab 40-A	Col.B 1960 MortRate Tab 40-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 1993 MortRate Tab 40-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	283.2	284.2	1.004	Avg Chg	1.0	Avg Chg	112.4	0.397	Avg Chg	-170.8	Avg Chg
NewE	297.1	347.1	1.168	TopTrio	50.0	TopTrio	117.8	0.396	TopTrio	-179.3	TopTrio
MidAtl	310.3	355.0	1.144	1.105	44.7	31.9	147.9	0.477	0.423	-162.4	-170.8
WNoCen	228.4	284.1	1.244	Avg Chg	55.7	Avg Chg	129.9	0.569	Avg Chg	-98.5	Avg Chg
ENoCen	258.9	320.8	1.239	MidTrio	61.9	MidTrio	140.5	0.543	MidTrio	-118.4	MidTrio
Mtn	214.8	256.8	1.196	1.226	42.0	53.2	101.2	0.471	0.528	-113.6	-110.2
WSoCen	206.1	269.4	1.307	Avg Chg	63.3	Avg Chg	137.6	0.668	Avg Chg	-68.5	Avg Chg
ESoCen	176.8	254.4	1.439	LowTrio	77.6	LowTrio	145.8	0.825	LowTrio	-31.0	LowTrio
SoAtl	222.0	286.4	1.290	1.345	64.4	68.4	128.7	0.580	0.691	-93.3	-64.3

Box 2, Chap. 64
Ischemic Heart Disease, Males: 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.

1940 Ischemic Heart Disease MortRates not available by Census Divisions and gender.

Census Div.	Col.A 1950 MR Tab 40-A	Col.B 1950 Pop'n Tab 3-B	Col.C 1950 Popn /53,964,513	Col.D Col.A * Col.C
Pacific	283.2	14,486,527	0.2684	76.02
NewEng	297.1	9,314,453	0.1726	51.28
Mid-Atl	310.3	30,163,533	0.5590	173.44
1950		Sum TopTrio 53,964,513	Sum 1.0000	TopTrio 300.747

Census Div.	Col.A 1960 MR Tab 40-A	Col.B 1960 Pop'n Tab 3-B	Col.C 1960 Popn /65,875,863	Col.D Col.A * Col.C
Pacific	284.2	21,198,044	0.3218	91.45
NewEng	347.1	10,509,367	0.1595	55.37
Mid-Atl	355.0	34,168,452	0.5187	184.13
1960		Sum TopTrio 65,875,863	Sum 1.0000	TopTrio 330.957

Census Div.	Col.A 1970 MR Tab 40-A	Col.B 1970 Pop'n Tab 3-B	Col.C 1970 Popn /75,017,000	Col.D Col.A * Col.C
Pacific	231.0	26,087,000	0.3477	80.33
NewEng	285.3	11,781,000	0.1570	44.80
Mid-Atl	300.8	37,149,000	0.4952	148.96
1970		Sum TopTrio 75,017,000	Sum 1.0000	TopTrio 274.093

Census Div.	Col.A 1980 MR Tab 40-A	Col.B 1980 Pop'n Tab 3-B	Col.C 1980 Popn /80,615,000	Col.D Col.A * Col.C
Pacific	177.7	31,523,000	0.3910	69.49
NewEng	223.5	12,322,000	0.1528	34.16
Mid-Atl	246.6	36,770,000	0.4561	112.48
1980		Sum TopTrio 80,615,000	Sum 1.0000	TopTrio 216.127

Census Div.	Col.A 1993 MR Tab 40-A	Col.B 1990 Pop'n Tab 3-B	Col.C 1990 Popn /88,495,000	Col.D Col.A * Col.C
Pacific	112.4	37,837,000	0.4276	48.06
NewEng	117.8	12,998,000	0.1469	17.30
Mid-Atl	147.9	37,660,000	0.4256	62.94
1993		Sum TopTrio 88,495,000	Sum 1.0000	TopTrio 128.301

• Part 2: Take ratios of these TopTrio MortRates, with 1950 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 1950 TopTrio Mean MR	Col.C = Col.A / Col.B	Col.D ppAdju Tab 47-B	Col.E = Col.C * Col.D	ISCHEMIC HEART DISEASE. Males.
				MidTrio		
1960	330.957	300.747	1.100	0.97	1.07	= MidTrio Adjustment Factor, 1960
1970	274.093	300.747	0.911	0.95	0.87	= MidTrio Adjustment Factor, 1970
1980	216.127	300.747	0.719	0.94	0.68	= MidTrio Adjustment Factor, 1980
1993	128.301	300.747	0.427	0.94	0.40	= MidTrio Adjustment Factor, 1993
				LowTrio		
1960	330.957	300.747	1.100	1.01	1.11	= LowTrio Adjustment Factor, 1960
1970	274.093	300.747	0.911	1.02	0.93	= LowTrio Adjustment Factor, 1970
1980	216.127	300.747	0.719	1.04	0.75	= LowTrio Adjustment Factor, 1980
1993	128.301	300.747	0.427	1.07	0.46	= LowTrio Adjustment Factor, 1993

Table 64-B
Ischemic Heart Disease, Males: 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 40-A	Col.C A * B	Col.D 1950 MR Mid,Low Tab 40-A	Col.E AdjuFact Bx2,Pt2 Col.E	Col.F 1960 Adju MortRates	Col.G A * F
Pacific	0.1182	284.2	33.592			284.2	33.592
New England	0.0586	347.1	20.340			347.1	20.340
Mid-Atlantic	0.1905	355.0	67.628			355.0	67.628
WestNoCentral	0.0858	284.1	24.376	228.4	1.07	244.388	20.968
EastNoCentral	0.2020	320.8	64.802	258.9	1.07	277.023	55.959
Mountain	0.0382	256.8	9.810	214.8	1.07	229.836	8.780
WestSoCentral	0.0945	269.4	25.458	206.1	1.11	228.771	21.619
EastSoCentral	0.0672	254.4	17.096	176.8	1.11	196.248	13.188
SouthAtlantic	0.1448	286.4	41.471	222.0	1.11	246.420	35.682
		Sum =	304.6				Sum =
1960 Observed MR from Table 40-B			306.5	1960 Natl Adjusted MR =			277.7552

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 Ischemic Ht. Dis. Males: 1960 Adjusted MortRates regressed on Mean 1940 thru 1960 PPs Regression Output:		Col.D 1940 PPs from Table 3-A (TrioSeq) x''	Col.E Ischemic Ht. Dis. Males: 1960 Adjusted MortRates regressed on 1940 PhysPops Regression Output:	
Pac	155.69	284.2	Constant	50.0790	159.72	Constant	52.9369
NewEng	162.81	347.1	Std Err of Y Est	20.5514	161.55	Std Err of Y Est	22.6343
MidAtl	167.04	355.0	R Squared	0.8733	169.76	R Squared	0.8463
WNoCen	118.15	244.388	No. of Observation	9	123.14	No. of Observation	9
ENoCen	123.87	277.023	Degrees of Freedom	7	133.36	Degrees of Freedom	7
Mtn	117.40	229.836			119.89		
WSoCen	102.31	228.771	X Coefficient(s)	1.7259	103.94	X Coefficient(s)	1.6690
ESoCen	85.63	196.248	Std Err of Coef.	0.2485	85.83	Std Err of Coef.	0.2688
SoAtl	101.72	246.420	XCoef / S.E. =	6.9463	100.74	XCoef / S.E.	6.2089

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

1. Nonradiation rate is Adjusted Constant (Part 2, Col.C) = 50.0790

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 277.7552) minus Nonradiation rate (50.0790) = 227.6762

3. 1960 Fractional Causation is radiation rate (227.6762) divided by OBSERVED Natl MR Part 1,Col.C= 306.5 = 0.74

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

1. Nonradiation rate is Adjusted Constant (Part 2, Col.E) = 52.9369

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 277.7552) minus Nonradiation rate (52.9369) = 224.8183

3. 1960 Fractional Causation is radiation rate (224.8183) divided by OBSERVED Natl MR Part 1, Col.C= 306.5 = 0.73

Table 64-C

Ischemic Heart Disease, Males: Fractional Causation in 1970

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 1970 PopFrac Tab 3-B	Col.B 1970 Obs MR Tab 40-A	Col.C A * B	Col.D 1950 MR Mid,Low Tab 40-A	Col.E AdjuFact Bx2,Pt2 Col.E	Col.F 1970 Adju MortRates	Col.G A * F
Pacific	0.1293	231.0	29.868			231.0	29.868
New England	0.0584	285.3	16.662			285.3	16.662
Mid-Atlantic	0.1842	300.8	55.407			300.8	55.407
WestNoCentral	0.0805	245.1	19.731	228.4	0.87	198.708	15.996
EastNoCentral	0.1993	274.1	54.628	258.9	0.87	225.243	44.891
Mountain	0.0408	215.2	8.780	214.8	0.87	186.876	7.625
WestSoCentral	0.0948	232.0	21.994	206.1	0.93	191.673	18.171
EastSoCentral	0.0631	236.8	14.942	176.8	0.93	164.424	10.375
SouthAtlantic	0.1496	248.7	37.206	222.0	0.93	206.460	30.886
		Sum =	259.2				Sum =
1970 Observed MR from Table 40-B			259.7	1970 Natl Adjusted MR =			229.8808

Part 2.

Trio-Seq.	Col.A Mean1940 thru1970 PPs from Tab 47-A x'	Col.B 1970 Adju MRs from Col.F Part 1 y	Col.C Ischemic Ht. Dis. Males: 1970 Adjusted MortRates regressed on Mean 1940 thru 1970 PPs		Col.D 1940 PPs from Table 3-A (TrioSeq) x''	Col.E Ischemic Ht. Dis. Males: 1970 Adjusted MortRates regressed on 1940 PhysPops	
			Regression Output:			Regression Output:	
Pac	162.72	231.0	Constant	42.1983	159.72	Constant	45.1199
NewEng	168.74	285.3	Std Err of Y Est	19.7900	161.55	Std Err of Y Est	21.6442
MidAtl	173.28	300.8	R Squared	0.8344	169.76	R Squared	0.8019
WNoCen	119.56	198.708	No. of Observation	9	123.14	No. of Observation	9
ENoCen	124.70	225.243	Degrees of Freedom	7	133.36	Degrees of Freedom	7
Mtn	122.37	186.876			119.89		
WSoCen	105.03	191.673	X Coefficient(s)	1.3710	103.94	X Coefficient(s)	1.3683
ESoCen	89.44	164.424	Std Err of Coef.	0.2309	85.83	Std Err of Coef.	0.2570
SoAtl	108.97	206.460	XCoef / S.E. =	5.9387	100.74	XCoef / S.E.	5.3232

Part 3-A.

Calculation of Fractional Causation from Averaged PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.C) = 42.1983

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 229.8808) minus Nonradiation rate (42.1983) = 187.6826

3. 1970 Fractional Causation is radiation rate (187.6826) divided by OBSERVED Natl MR Part 1,Col.C= 259.7 = 0.72

Part 3-B.

Calculation of Fractional Causation from 1940 PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.E) = 45.1199

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 229.8808) minus Nonradiation rate (45.1199) = 184.7609

3. 1970 Fractional Causation is radiation rate (184.7609) divided by OBSERVED Natl MR Part 1, Col.C= 259.7 = 0.71

Table 64-D

Ischemic Heart Disease, Males: 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 40-A	Col.C A * B	Col.D 1950 MR Mid,Low Tab 40-A	Col.E AdjuFact Bx2,Pt2 Col.E	Col.F 1980 Adju MortRates	Col.G A * F
Pacific	0.1398	177.7	24.842			177.7	24.842
New England	0.0546	223.5	12.203			223.5	12.203
Mid-Atlantic	0.1630	246.6	40.196			246.6	40.196
WestNoCentral	0.0759	206.1	15.643	228.4	0.68	155.312	11.788
EastNoCentral	0.1846	227.4	41.978	258.9	0.68	176.052	32.499
Mountain	0.0502	173.6	8.715	214.8	0.68	146.064	7.332
WestSoCentral	0.1049	194.5	20.403	206.1	0.75	154.575	16.215
EastSoCentral	0.0646	219.2	14.160	176.8	0.75	132.600	8.566
SouthAtlantic	0.1624	210.9	34.250	222.0	0.75	166.500	27.040
		Sum =	212.4				Sum =
1980 Observed MR from Table 40-B			212.8	1980 Natl Adjusted MR =			180.6816

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	Col.C Ischemic Ht. Dis. Males: 1980 Adjusted MortRates regressed on Mean 1940 thru 1980 PPs Regression Output:		Col.D 1940 PPs from Table 3-A (TrioSeq) x''	Col.E Ischemic Ht. Dis. Males: 1980 Adjusted MortRates regressed on 1940 PhysPops Regression Output:	
Pac	177.35	177.7	Constant	31.0994	159.72	Constant	38.4779
NewEng	185.86	223.5	Std Err of Y Est	18.9493	161.55	Std Err of Y Est	20.5756
MidAtl	186.11	246.6	R Squared	0.7714	169.76	R Squared	0.7305
WNoCen	128.82	155.3	No. of Observation	9	123.14	No. of Observation	9
ENoCen	133.71	176.1	Degrees of Freedom	7	133.36	Degrees of Freedom	7
Mtn	133.45	146.1			119.89		
WSoCen	114.66	154.6	X Coefficient(s)	1.0117	103.94	X Coefficient(s)	1.0645
ESoCen	99.46	132.6	Std Err of Coef.	0.2081	85.83	Std Err of Coef.	0.2444
SoAtl	124.62	166.5	XCoef / S.E. =	4.8608	100.74	XCoef / S.E.	4.3563

Part 3-A.

Calculation of Fractional Causation from Averaged PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.C) = 31.0994

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 180.6816) minus Nonradiation rate (31.0994) = 149.5822

3. 1980 Fractional Causation is radiation rate (149.5822) divided by OBSERVED Natl MR Part 1,Col.C= 212.8 = 0.70

Part 3-B.

Calculation of Fractional Causation from 1940 PhysPops

1. Nonradiation rate is Adjusted Constant (Part 2, Col.E) = 38.4779

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 180.6816) minus Nonradiation rate (38.4779) = 142.2037

3. 1980 Fractional Causation is radiation rate (142.2037) divided by OBSERVED Natl MR Part 1, Col.C= 212.8 = 0.67

Table 64-E

Ischemic Heart Disease, Males: Fractional Causation in 1993

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 1993 Obs MR Tab 40-A	Col.C A * B	Col.D 1950 MR Mid,Low Tab 40-A	Col.E AdjuFact Bx2,Pt2 Col.E	Col.F 1993 Adju MortRates	Col.G A * F
Pacific	0.1535	112.4	17.253			112.4	17.253
New England	0.0527	117.8	6.208			117.8	6.208
Mid-Atlantic	0.1527	147.9	22.584			147.9	22.584
WestNoCentral	0.0721	129.9	9.366	228.4	0.40	91.360	6.587
EastNoCentral	0.1713	140.5	24.068	258.9	0.40	103.560	17.740
Mountain	0.0543	101.2	5.495	214.8	0.40	85.920	4.665
WestSoCentral	0.1087	137.6	14.957	206.1	0.46	94.806	10.305
EastSoCentral	0.0621	145.8	9.054	176.8	0.46	81.328	5.050
SouthAtlantic	0.1725	128.7	22.201	222.0	0.46	102.120	17.616
		Sum =	131.2				Sum =
1993 Observed MR from Table 40-B			131.0	1993 Natl Adjusted MR =			108.0097

Part 2.

Trio-Seq.	Col.A Mean1940 thru1990 PPs from Tab 47-A x'	Col.B 1993 Adju MRs from Part 1 y
Pac	191.97	112.4
NewEng	208.20	117.8
MidAtl	204.72	147.9
WNoCen	141.14	91.360
ENoCen	146.19	103.560
Mtn	145.91	85.920
WSoCen	126.28	94.806
ESoCen	113.28	81.328
SoAtl	142.93	102.120

Col.C Ischemic Ht. Dis. Males: 1993 Adjusted MortRates regressed on Mean 1940 thru 1990 PPs	
Regression Output:	
Constant	25.6954
Std Err of Y Est	11.2868
R Squared	0.7279
No. of Observation	9
Degrees of Freedom	7
X Coefficient(s)	0.4969
Std Err of Coef.	0.1148
XCoef / S.E. =	4.3271

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 Ischemic Ht. Dis. Males: 1993 Adjusted MortRates regressed on 1940 PhysPops	
Regression Output:	
Constant	31.6182
Std Err of Y Est	12.0989
R Squared	0.6873
No. of Observation	9
Degrees of Freedom	7
X Coefficient(s)	0.5636
Std Err of Coef.	0.1437
XCoef / S.E.	3.9225

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

1. Nonradiation rate is Adjusted Constant (Part 2, Col.C) = 25.6954

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 108.0097) minus Nonradiation rate (25.6954) = 82.3143

3. 1993 Fractional Causation is radiation rate (82.3143) divided by OBSERVED Natl MR Part 1,Col.C= 131.0 = 0.63

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

1. Nonradiation rate is Adjusted Constant (Part 2, Col.E) = 31.6182

2. Radiation rate is Natl Adjusted MortRate (Part 1, Col.G = 108.0097) minus Nonradiation rate (31.6182) = 76.3915

3. 1993 Fractional Causation is radiation rate (76.3915) divided by OBSERVED Natl MR Part 1, Col.C= 131.0 = 0.58