

CHAPTER 11

Urinary-System Cancers, Males: Relation with Medical Radiation

● Part 1. Introduction

Urinary-System Cancers include cancers of the kidney, bladder, "and other urinary organs" (Chapter 4, Part 5, Number 10).

This study produces negative Constants for the central estimate and for both of the confidence-limits on the X-Coefficient --- as shown in Box 3. In this situation, we hesitate to use any value for Fractional Causation in Figure 11-A. Instead, we will say that the true Fractional Causation is far more likely to be near 100% than to be a low percentage. The dose-response in Part 2j is highly significant.

● Part 2. How the Dose-Response Develops, 1921-1940

| ● - Part 2a. | 1921 | 1940 | Urinary-System Ca, Males | |
|--------------------|---------|----------|--------------------------|---------|
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 165.11 | 8.1 | Constant | -5.9634 |
| New England | 142.24 | 9.1 | Std Err of Y Est | 1.9211 |
| West North Central | 140.93 | 6.7 | R Squared | 0.4030 |
| Mid-Atlantic | 137.29 | 10.2 | No. of Observations | 9 |
| East North Central | 136.06 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 135.38 | 6.5 | X Coefficient(s) | 0.0948 |
| West South Central | 125.15 | 4.3 | Std Err of Coef. | 0.0436 |
| East South Central | 119.76 | 3.0 | Coefficient / S.E. | 2.1736 |
| South Atlantic | 110.32 | 5.3 | | |

| ● - Part 2b. | 1923 | 1940 | Urinary-System Ca, Males | |
|--------------------|---------|----------|--------------------------|---------|
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 163.06 | 8.1 | Constant | -5.9647 |
| New England | 137.39 | 9.1 | Std Err of Y Est | 1.7752 |
| West North Central | 138.31 | 6.7 | R Squared | 0.4902 |
| Mid-Atlantic | 138.92 | 10.2 | No. of Observations | 9 |
| East North Central | 131.82 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 130.51 | 6.5 | X Coefficient(s) | 0.0975 |
| West South Central | 119.16 | 4.3 | Std Err of Coef. | 0.0376 |
| East South Central | 113.16 | 3.0 | Coefficient / S.E. | 2.5942 |
| South Atlantic | 106.79 | 5.3 | | |

| ● - Part 2c. | 1925 | 1940 | Urinary-System Ca, Males | |
|--------------------|---------|----------|--------------------------|---------|
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 161.67 | 8.1 | Constant | -5.0874 |
| New England | 138.31 | 9.1 | Std Err of Y Est | 1.7094 |
| West North Central | 133.92 | 6.7 | R Squared | 0.5273 |
| Mid-Atlantic | 134.36 | 10.2 | No. of Observations | 9 |
| East North Central | 127.54 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 122.30 | 6.5 | X Coefficient(s) | 0.0938 |
| West South Central | 112.83 | 4.3 | Std Err of Coef. | 0.0336 |
| East South Central | 107.22 | 3.0 | Coefficient / S.E. | 2.7943 |
| South Atlantic | 103.61 | 5.3 | | |

| ● - Part 2d. | 1927 | 1940 | Urinary-System Ca, Males | |
|--------------------|---------|----------|--------------------------|---------|
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 157.83 | 8.1 | Constant | -5.6854 |
| New England | 137.50 | 9.1 | Std Err of Y Est | 1.4594 |
| West North Central | 131.54 | 6.7 | R Squared | 0.6554 |
| Mid-Atlantic | 138.40 | 10.2 | No. of Observations | 9 |
| East North Central | 126.18 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 118.75 | 6.5 | | |

| | | | | |
|--------------------|---------|----------|--------------------------|---------|
| West South Central | 108.25 | 4.3 | X Coefficient(s) | 0.1002 |
| East South Central | 102.07 | 3.0 | Std Err of Coef. | 0.0275 |
| South Atlantic | 102.13 | 5.3 | Coefficient / S.E. | 3.6490 |
| | | | | |
| ● - Part 2e. | 1929 | 1940 | Urinary-System Ca, Males | |
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 156.64 | 8.1 | Constant | -5.6251 |
| New England | 138.46 | 9.1 | Std Err of Y Est | 1.3498 |
| West North Central | 128.72 | 6.7 | R Squared | 0.7052 |
| Mid-Atlantic | 138.49 | 10.2 | No. of Observations | 9 |
| East North Central | 126.51 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 118.68 | 6.5 | | |
| West South Central | 105.60 | 4.3 | X Coefficient(s) | 0.1005 |
| East South Central | 99.41 | 3.0 | Std Err of Coef. | 0.0246 |
| South Atlantic | 100.86 | 5.3 | Coefficient / S.E. | 4.0924 |
| | | | | |
| ● - Part 2f. | 1931 | 1940 | Urinary-System Ca, Males | |
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 159.97 | 8.1 | Constant | -4.7933 |
| New England | 142.35 | 9.1 | Std Err of Y Est | 1.2911 |
| West North Central | 126.50 | 6.7 | R Squared | 0.7303 |
| Mid-Atlantic | 140.82 | 10.2 | No. of Observations | 9 |
| East North Central | 128.59 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 118.89 | 6.5 | | |
| West South Central | 105.95 | 4.3 | X Coefficient(s) | 0.0933 |
| East South Central | 96.73 | 3.0 | Std Err of Coef. | 0.0214 |
| South Atlantic | 99.59 | 5.3 | Coefficient / S.E. | 4.3539 |
| | | | | |
| ● - Part 2g. | 1934 | 1940 | Urinary-System Ca, Males | |
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 160.09 | 8.1 | Constant | -4.0741 |
| New England | 148.60 | 9.1 | Std Err of Y Est | 1.0558 |
| West North Central | 125.96 | 6.7 | R Squared | 0.8197 |
| Mid-Atlantic | 149.62 | 10.2 | No. of Observations | 9 |
| East North Central | 129.36 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 117.16 | 6.5 | | |
| West South Central | 104.68 | 4.3 | X Coefficient(s) | 0.0870 |
| East South Central | 92.00 | 3.0 | Std Err of Coef. | 0.0154 |
| South Atlantic | 98.41 | 5.3 | Coefficient / S.E. | 5.6404 |
| | | | | |
| ● - Part 2h. | 1936 | 1940 | Urinary-System Ca, Males | |
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 158.44 | 8.1 | Constant | -4.0632 |
| New England | 150.18 | 9.1 | Std Err of Y Est | 0.8826 |
| West North Central | 126.14 | 6.7 | R Squared | 0.8740 |
| Mid-Atlantic | 155.05 | 10.2 | No. of Observations | 9 |
| East North Central | 130.42 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 119.80 | 6.5 | | |
| West South Central | 103.52 | 4.3 | X Coefficient(s) | 0.0864 |
| East South Central | 89.94 | 3.0 | Std Err of Coef. | 0.0124 |
| South Atlantic | 99.16 | 5.3 | Coefficient / S.E. | 6.9672 |
| | | | | |
| ● - Part 2i. | 1938 | 1940 | Urinary-System Ca, Males | |
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 157.62 | 8.1 | Constant | -3.6578 |
| New England | 154.08 | 9.1 | Std Err of Y Est | 0.7547 |
| West North Central | 124.95 | 6.7 | R Squared | 0.9079 |
| Mid-Atlantic | 160.69 | 10.2 | No. of Observations | 9 |
| East North Central | 131.98 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 119.88 | 6.5 | | |
| West South Central | 102.79 | 4.3 | X Coefficient(s) | 0.0827 |
| East South Central | 88.21 | 3.0 | Std Err of Coef. | 0.0100 |
| South Atlantic | 99.26 | 5.3 | Coefficient / S.E. | 8.3046 |
| | | | | |
| ● - Part 2j. | 1940 | 1940 | Urinary-System Ca, Males | |
| | PhysPop | MortRate | Regression Output: | |
| Pacific | 159.72 | 8.1 | Constant | -2.8335 |

| | | | | |
|--------------------|--------|------|---------------------|--------|
| New England | 161.55 | 9.1 | Std Err of Y Est | 0.6997 |
| West North Central | 123.14 | 6.7 | R Squared | 0.9208 |
| Mid-Atlantic | 169.76 | 10.2 | No. of Observations | 9 |
| East North Central | 133.36 | 8.1 | Degrees of Freedom | 7 |
| Mountain | 119.89 | 6.5 | | |
| West South Central | 103.94 | 4.3 | X Coefficient(s) | 0.0750 |
| East South Central | 85.83 | 3.0 | Std Err of Coef. | 0.0083 |
| South Atlantic | 100.74 | 5.3 | Coefficient / S.E. | 9.0208 |

| <i>Box 1 of Chap. 11</i> | | | | | | |
|---|----------|-----------|----------|--------|---------|-----------|
| <i>Summary: Regression Outputs, Urinary-System Cancers, Males.</i> | | | | | | |
| Below are the summary-results from all the calculations of Part 2, for the 1940 MortRates regressed on PhysPop. | | | | | | |
| Part | PhysPop | R-squared | Constant | X-Coef | Std Err | X-Coef/SE |
| 2a | 1921 | 0.4030 | -5.96 | 0.0948 | 0.0436 | 2.1736 |
| 2b | 1923 | 0.4902 | -5.96 | 0.0975 | 0.0376 | 2.5942 |
| 2c | 1925 | 0.5273 | -5.09 | 0.0938 | 0.0336 | 2.7943 |
| 2d | 1927 | 0.6554 | -5.69 | 0.1002 | 0.0275 | 3.6490 |
| 2e | 1929 | 0.7052 | -5.63 | 0.1005 | 0.0246 | 4.0924 |
| 2f | 1931 | 0.7303 | -4.79 | 0.0933 | 0.0214 | 4.3539 |
| 2g | 1934 | 0.8197 | -4.07 | 0.0870 | 0.0154 | 5.6404 |
| 2h | 1936 | 0.8740 | -4.06 | 0.0864 | 0.0124 | 6.9672 |
| 2i | 1938 | 0.9079 | -3.66 | 0.0827 | 0.0100 | 8.3046 |
| 2j ----> | 1940 Max | 0.9208 | -2.83 | 0.0750 | 0.0083 | 9.0208 |

| <i>Box 2 of Chap. 11</i> | | | |
|---|------------------------------|-------------------------------|--------------------------------|
| <i>Input-Data for Figure 11-A. Urinary-System Cancers. Males.</i> | | | |
| Part 2j, Best-Fit Equation: Calc. MortRate = (0.0750 * PhysPop) + (-2.83) | | | |
| Census Divisions | 1940 Observed PhysPops | 1940 Observed MortRates | Best-Fit Calc. MortRates |
| Pacific | 159.72 | 8.1 | 9.149 |
| New England | 161.55 | 9.1 | 9.286 |
| West No. Central | 123.14 | 6.7 | 6.406 |
| Mid-Atlantic | 169.76 | 10.2 | 9.902 |
| East No. Central | 133.36 | 8.1 | 7.172 |
| Mountain | 119.89 | 6.5 | 6.162 |
| West So. Central | 103.94 | 4.3 | 4.966 |
| East So. Central | 85.83 | 3.0 | 3.607 |
| South Atlantic | 100.74 | 5.3 | 4.725 |
| Additional PhysPops | 70.00 | | 2.420 |
| --- not "observed" --- | 60.00 | | 1.670 |
| down to zero PhysPop | 50.00 | | 0.920 |
| (zero medical radiation). | 40.00 | | 0.170 |
| For each, we calculate | 30.00 | | -0.580 |
| a best-fit MortRate. | 20.00 | | -1.330 |
| These additional x,y pairs | 10.00 | | -2.080 |
| are also part of the | 0 | | -2.830 |
| best-fit line (Chap 5, Part 5e). | | | |

Box 3 of Chap. 11
Presumptive Fraction of Cancer MortRate Attributable to Medical Radiation.

Please see text in Chapter 6, Parts 4 and 6.

Urinary-System Cancers. MALES.

- MALE National MortRate (MR) 1940, from Table 11-B 7.4 National MortRate
- Constant, from regression, Part 2j -2.8335 Constant
- Fractional Causation, Best Est. = (Natl MR - Constant) / Natl MR 138.3% Frac. Causation
- # The Upper-Limit is 100%. Negative Constants produce values > 100%. See Chapter 22, Part 3.

90% Confidence-Limits (C.L.) on Fractional Causation. See text in Chapter 6, Part 4b, please.

- X-Coefficient, from Part 2j 0.0750 X-Coef., Best Est.
- Standard Error (SE) of X-Coefficient, from Part 2j 0.0083 Standard Error
- Upper 90% C.L. on X-Coef. = (Coef) + (1.645 * SE) = 0.0887 New X-Coefficient
- New Constant = (Natl MR) - (New X-Coef * 1940 Natl PhysPop) = -4.3058 New Constant
- Frac. Causation, High-Limit = (Natl MR - New Constant) / Natl MR = 158.2% New Frac. Caus'n.
- # The Upper-Limit is 100%. Negative Constants produce values > 100%. See Chapter 22, Part 3.
- Lower 90% C.L. on X-Coef. = (Coef) - (1.645 * SE) = 0.0613 New X-Coefficient
- New Constant = (Natl MR) - (New X-Coef * 1940 Natl PhysPop) = -0.7002 New Constant
- Frac. Causation, Low-Limit = (Natl MR - New Constant) / Natl MR = 109.5% New Frac. Caus'n.
- # The Upper-Limit is 100%. Negative Constants produce values > 100%. See Chapter 22, Part 3.

Box 4 of Chap. 11
Error-Check on Our Own Work: Urinary-System Cancers, Males.

Please see text in Chapter 6, Part 5.

Below, Columns A, C, and E come directly from the regression input in Part 2j. Column B, the fraction of the whole 1940 population in each Census Division, comes from Table 3-B in Chapter 3. Each Column-D entry is the product of (B-entry times C-entry). Each Column-F entry is the product of (B-entry times E-entry). PhysPops and MortRates are each "per 100,000."

The Weighted-Avg. Nat'l PhysPop, 1940, is the sum of Column-D entries = 132.04

The Weighted-Avg. Nat'l Male MortRate, 1940, is sum of Col.F entries = 7.24

The Nat'l Male MortRate is also (X-Coef * Nat'l PhysPop) + Constant = 7.07

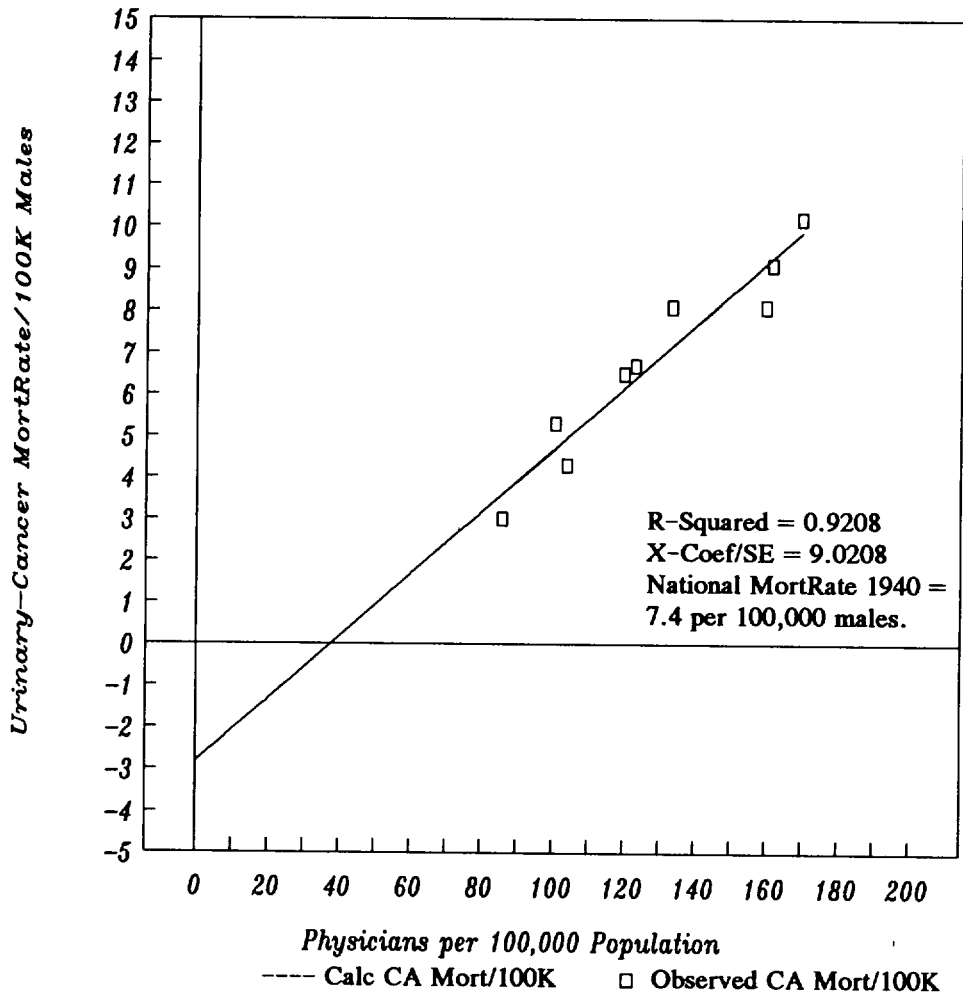
Comparison: The Nat'l Male MortRate, 1940, in Table 11-B = 7.40

| (A) Census Division | (B) Pop'n Fraction | (C) PhysPop 1940 | (D) 1940 Weighted PhysPop | (E) MortRate 1940 | (F) Weighted MortRate |
|---------------------------|--------------------------|------------------------|---------------------------------|-------------------------|-----------------------------|
| Pacific | 0.0739 | 159.72 | 11.80 | 8.1 | 0.60 |
| New England | 0.0641 | 161.55 | 10.36 | 9.1 | 0.58 |
| West No. Central | 0.1027 | 123.14 | 12.65 | 6.7 | 0.69 |
| Mid-Atlantic | 0.2092 | 169.76 | 35.51 | 10.2 | 2.13 |
| East No. Central | 0.2022 | 133.36 | 26.97 | 8.1 | 1.64 |
| Mountain | 0.0315 | 119.89 | 3.78 | 6.5 | 0.20 |
| West So. Central | 0.0992 | 103.94 | 10.31 | 4.3 | 0.43 |
| East So. Central | 0.0819 | 85.83 | 7.03 | 3.0 | 0.25 |
| South Atlantic | 0.1354 | 100.74 | 13.64 | 5.3 | 0.72 |
| Sums | 1.0000 | | 132.04 | | 7.24 |

**1940 Urinary-System Cancer Mortality-Rates versus
1940 PhysPop Values for the 9 Census Divisions, US**

Dose-Response Relationship

PhysPop is a surrogate for accumulated dose from medical irradiation.



On the X-axis, PhysPop values = Physicians per 100,000 Population in the Nine Census Divisions of the USA Population, Year 1940. This variable is a surrogate for accumulated radiation dose --- the more physicians per 100,000 people, the more radiation procedures are done per 100,000 people.

On the Y-axis, Urinary-Cancer Mortality-Rate per 100,000 males = the reported rates in USA Vital Statistics for the Nine Census Divisions, Year 1940.

Shown above is the strongest relationship between these two variables (Part 2j). The nine datapoints (boxy symbols) were collected long ago for other purposes, and are free from potential bias with respect to this dose-response study.

Fractional Causation of Urinary-System Cancer Mortality-Rate (Male) by Medical Radiation: ~100 % is far more likely than a low percent. See Text, Part 1.

Table 11-A.

Urinary-System Cancer Mortality Rates by Census Divisions: Males.

Rates are annual deaths per 100,000 male population, USA, age-adjusted to the 1940 reference year. There are no exclusions by color or "race." Sources are stated in Table 11-B, and described in Chap. 4, Part 2. The Nine Census-Division MortRates are population-weighted (Chap. 4, Part 2b). The averages below them are not.

| Census Division | 1940 | 1950 | 1960 | 1970 | 1980 | 1990 |
|--------------------|------|------|------|------|------|------|
| Pacific | 8.1 | 8.4 | 8.2 | 8.0 | 7.7 | -- |
| New England | 9.1 | 10.5 | 10.7 | 10.1 | 9.5 | -- |
| West North Central | 6.7 | 7.2 | 8.3 | 8.1 | 7.9 | -- |
| Mid-Atlantic | 10.2 | 10.5 | 10.2 | 9.7 | 9.2 | -- |
| East North Central | 8.1 | 8.6 | 9.4 | 9.1 | 8.7 | -- |
| Mountain | 6.5 | 6.1 | 7.8 | 7.4 | 7.0 | -- |
| West South Central | 4.3 | 5.8 | 6.6 | 6.8 | 7.0 | -- |
| East South Central | 3.0 | 5.0 | 5.2 | 6.3 | 7.3 | -- |
| South Atlantic | 5.3 | 6.1 | 6.9 | 7.4 | 7.8 | -- |
| Average, ALL | 6.8 | 7.6 | 8.1 | 8.1 | 8.0 | -- |
| Average, High-5 | 8.4 | 9.0 | 9.4 | 9.0 | 8.6 | -- |
| Average, Low-4 | 4.8 | 5.8 | 6.6 | 7.0 | 7.3 | -- |
| Ratio, Hi5/Lo4 | 1.77 | 1.57 | 1.41 | 1.29 | 1.18 | -- |

Table 11-B.

Urinary-System Cancer Mortality Rates, USA National.

Rates are age-adjusted to the 1940 reference year. Both sexes: Deaths per 100,000 population (males + females). Males: Deaths per 100,000 male population. Females: Deaths per 100,000 female population. No exclusions by color or "race."

| | Both Sexes | Male | Female |
|---------|------------|------|--------|
| 1940 | 5.7 | 7.4 | 4.0 |
| 1950 | 6.0 | 8.1 | 3.9 |
| 1960 | 5.9 | 8.5 | 3.6 |
| 1970 | 5.6 | 8.35 | 3.3 |
| 1979-81 | 5.2 | 8.2 | 3.0 |
| 1990 | -- | -- | -- |

- - 1940, 1950, 1960: All rates come from Grove 1968, Table 67, p.697, "Malignant neoplasm of urinary organs (180-181)" ICD/7.
- - 1970: All rates are interpolations (Chap. 4, Parts 2b, 2c).
- - 1980: All rates (ICD/9, 188-189) come from the reference NatCtrHS 1980.
- - 1990: No data obtained. Please see Chap.4, Part 2c.