Cancer Incidence and Mortality Rates in Ohio:
Impact of Appalachian and Metropolitan/Non-metropolitan Residence

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Background

Ohio:
- 10th highest cancer incidence
- 9th highest cancer mortality

Geographically diverse:
- Highly metropolitan and rural areas
- Appalachia – 32 eastern and southern counties
  - High poverty and unemployment
  - Low educational levels, income, and cancer screening rates

Purpose: to differentiate urban/rural differences in cancer rates from Appalachian/non-Appalachian factors

Methods

Created 4 groupings of Ohio's 88 counties:
- Metropolitan/Non-Appalachia
- Nonmetropolitan/Non-Appalachia
- Metropolitan/Appalachia
- Nonmetropolitan/Appalachia

Compared most recent, average annual, age-adjusted incidence and mortality rates for all cancer sites combined and 5 leading cancers in four county groupings for males and females, separately.

Differences visualized in 2x2 heatmaps.
- Each 2x2 table has its own scale.
- Lowest rates are shown in the lightest color(white). Highest rates are shown in the darkest color.

Explanation of Results

Incidence Disparities
All cancers combined: Highest rates among non-metropolitan Appalachia.
Lung and cervical cancers: Higher rates in Appalachia, especially non-metropolitan Appalachian counties for lung cancer.
Colon and rectum: Higher rates among Appalachian metropolitan males and females and non-Appalachian non-metropolitan females.
Female breast and prostate cancer: Higher rates in non-Appalachian metropolitan areas.

Mortality Disparities
All cancers combined: Higher rates in Appalachian and non-metropolitan counties, with highest rates among non-metropolitan Appalachian males and females.
Lung and cervical cancers: Higher rates in Appalachia, and an additional non-metropolitan lung cancer disparity among males.
Colon and rectum: Complex disparities of higher rates among non-metropolitan males, non-Appalachian non-metropolitan females, and Appalachian non-metropolitan males and females.
Female breast and prostate cancers: No substantive disparities.

Results

Figure 1: Map of Study Area
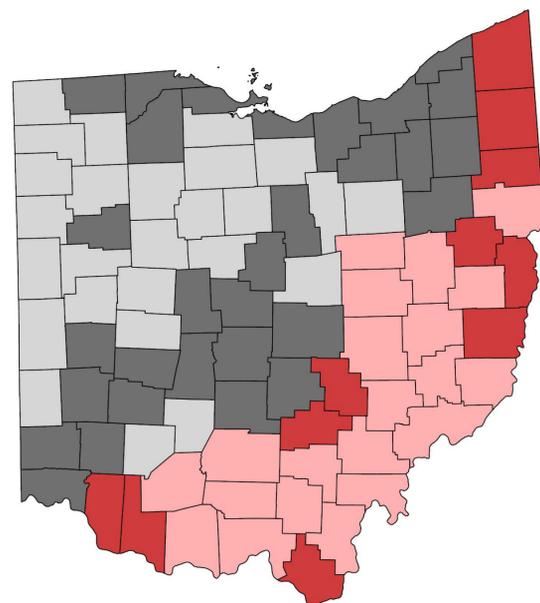
- Urban Appalachia
- Rural Appalachia
- Urban Non-Appalachia
- Rural Non-Appalachia

Number of Counties	Rural	Urban
Appalachian	21	11
Non-Appalachian	26	30

Figure 2: Average Annual Age-adjusted Cancer Incidence[1] and Mortality[2] Rates by Gender and Geography

All Cancers

Male Incidence[1]:
	Non-Appalachia	Appalachia
Metro	512.5	509.0
Non-Metro	501.3	520.8

Colon & Rectum
	Non-Appalachia	Appalachia
Metro	42.6	46.5
Non-Metro	45.4	45.6

Lung & Bronchus
	Non-Appalachia	Appalachia
Metro	67.9	79.3
Non-Metro	70.3	86.4

Prostate
	Non-Appalachia	Appalachia
Metro	125.4	112.5
Non-Metro	111.5	102.9

Female Incidence[1]:

All Cancers
	Non-Appalachia	Appalachia
Metro	445.1	441.0
Non-Metro	431.8	459.6

Colon & Rectum
	Non-Appalachia	Appalachia
Metro	32.1	36.0
Non-Metro	36.7	36.3

Lung & Bronchus
	Non-Appalachia	Appalachia
Metro	56.1	62.2
Non-Metro	52.1	65.7

Female Breast
	Non-Appalachia	Appalachia
Metro	137.3	124.1
Non-Metro	127.6	115.5

Cervical
	Non-Appalachia	Appalachia
Metro	7.6	7.9
Non-Metro	7.1	10.2

Male Mortality[2]:

All Cancers
	Non-Appalachia	Appalachia
Metro	186.6	201.4
Non-Metro	199.8	219.9

Colon & Rectum
	Non-Appalachia	Appalachia
Metro	15.8	17.2
Non-Metro	19.2	19.6

Lung & Bronchus
	Non-Appalachia	Appalachia
Metro	43.2	54.9
Non-Metro	49.8	60.3

Prostate
	Non-Appalachia	Appalachia
Metro	19.9	18.0
Non-Metro	18.5	20.0

Female Mortality[2]:

All Cancers
	Non-Appalachia	Appalachia
Metro	135.3	141.5
Non-Metro	140.4	149.1

Colon & Rectum
	Non-Appalachia	Appalachia
Metro	10.8	12.4
Non-Metro	13.1	12.8

Lung & Bronchus
	Non-Appalachia	Appalachia
Metro	31.4	37.1
Non-Metro	32.2	39.0

Female Breast
	Non-Appalachia	Appalachia
Metro	20.2	19.3
Non-Metro	19.7	19.9

Cervical
	Non-Appalachia	Appalachia
Metro	2.2	3.0
Non-Metro	2.2	2.9

Discussion

- No one geography stood alone consistently having the highest rate.
  - Combination or interplay between the two factors.
- Interpreting county-level incidence and mortality rates within a state is complex because of the interplay of multiple geographic factors.
  - Single geographic factors should not be considered in a vacuum.
- This work could be replicated with:
  - Additional cancer sites and/or types
  - Other states
  - Additional factors

References:
Incidence Data Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2025.
*Mortality Data Source: Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Mortality - All COD, Aggregated With County, Total U.S. (1990-2023) <Katrina/Rita Population Adjustment> - Linked To County Attributes - Total U.S., 1969-2023 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, released February 2025. Underlying mortality data provided by NCHS (www.cdc.gov/nchs).*

Notes:
[1]Average Annual Age-Adjusted Incidence Rate per 100,000 from 2018-2022
[2]Average Annual Age Adjusted Mortality Rate per 100,000 from 2019-2023