

Northeast Ohio Trends in Early Onset Cancer Incidence and Mortality

A data brief for the Case Comprehensive Cancer Center community

Who is this report for?

The Case Comprehensive Cancer Center (CCC) Population Cancer Analytics Shared Resource (PCA-SR) has designed this report to serve the needs of:

- Members of the Northeast Ohio clinical community who may use this information to understand risk in their patients or to contextualize patterns of presentation they are seeing in their own practice
- Case CCC scientists with an interest in the drivers or mediators of early onset cancers
- Community outreach and engagement (COE) professionals wishing to target educational or other interventions aimed at improving catchment area outcomes
- Community partners who may use the information provided to set priorities, inform the public, or advocate

Introduction

The last decade has seen mounting concern over the rising incidence of early onset cancers—defined as cancer diagnosed in individuals younger than 50 years of age.^{1,2} Nationally, early onset cancer has risen by more than 15% since 2000.³ While initiation of screening at younger ages, greater screening uptake, and improved methods of detection may partially explain some of the increase², a number of other trends emerging in the latter half of the twentieth century are theorized to play causative roles. Most of the evidence to date points to lifestyle and/or environmental factors.² The steady rise in obesity (whose prevalence in American adults has climbed from 22.9% to 42.4% between 1988 and 2018⁴) and associated metabolic dysfunction has been a central focus of proposed explanations for increased early onset cancer. Obesity is an established risk factor for multiple cancers including colorectal, kidney, pancreatic, esophageal, and endometrial⁵; visceral fat, in particular, is believed to play a disproportionate role in the carcinogenicity of obesity.⁶

The western diet—high in meat and processed food, and low in fiber—has also been identified as an independent risk factor for many gastrointestinal cancers.^{7,8} The combined effects of such a diet, coupled with the effects of a sedentary lifestyle, may contribute to gut microbiome dysbiosis. This dysbiosis in turn likely fosters an inflammatory, tumor-promoting environment, which has been implicated in early-onset colorectal cancer (CRC) particularly.⁹

Increased hormonal exposure over the life course represents yet another major potential contributor to the rise in early-onset cancers. Evidence points, in particular, to the roles of increased endogenous sex hormone exposure among women¹⁰ and endocrine disrupting chemicals in the environment.¹¹⁻¹³ The latter are thought to arise largely from industrial processes, consumer products, agricultural runoff, and improperly managed waste streams.¹⁴ Additional novel risk factors and the relative contributions of various factors are active areas of investigation.

While the national epidemiology of early onset cancers is well-documented, we seek to shed light on the burden specific to northeast Ohio, the catchment area for the Case Comprehensive Cancer Center (Case CCC). Our goals with this data brief are to 1) highlight major cancer types with elevated or substantially changing early incidence or mortality rates in the catchment area over time, 2) compare and contrast those trends with national trends, and 3) highlight key questions raised or opportunities for local action.

Methods

This data brief focuses on the population of Case CCC, comprising the 15 northeastern Ohio counties of Ashland, Ashtabula, Cuyahoga, Erie, Geauga, Huron, Lake, Lorain, Mahoning, Medina, Portage, Stark, Summit, Trumbull, and Wayne during the period of 1996-2023. Early onset cancer was defined as cancer diagnosed in individuals younger than 50 years of age. Age-adjusted incidence and mortality were calculated using the direct method of age adjustment¹⁵ with the 2000 U.S. standard population as the reference.¹⁶ Local cancer case counts were obtained from the Ohio Cancer Incidence Surveillance System (OCISS), Ohio's central cancer registry, under a data use agreement with the Ohio Department of Health. Age-stratified population denominator data for local rates came from Surveillance, Epidemiology, and End Results (SEER) Program population files.¹⁷ National age-adjusted incidence rates were drawn from the Cancer in North America (data only available through 2022)¹⁸ data compiled by the North American Association of Central Cancer Registries (NAACCR). Local and national age-adjusted cause-of-death-specific mortality rates were drawn from National Center for Health Statistics data provided through the SEER Program.¹⁹

We report 10-year (2014-2023) aggregated age-adjusted incidence and mortality rates for lung and bronchus, colorectal (excluding appendix), prostate, and female breast cancers, as well as for the composite category of *obesity-related cancers*, which include cancers of the esophagus, breast, colorectum, uterus, gallbladder, stomach, kidney and renal pelvis, liver and intrahepatic bile duct, ovary, pancreas, and thyroid, as well as myeloma.²⁰ We do not report confidence intervals for US aggregated rates as these represent essentially complete population-wide data, not sample-based statistics.

We estimated annual percent changes in incidence and mortality using joinpoint regression (version 6.0.1, National Cancer Institute). The joinpoint model begins by fitting a single trendline to time-series data and adds inflection points, called “joinpoints”, to create additional segments as needed to improve model fit. A non-statistically significant slope can be interpreted as being statistically indistinguishable from a flat line.

In [supplemental online materials](#), we report 10-year aggregated incidence and mortality as well as trends for additional cancer types, including kidney cancers, lymphoma, melanoma, pancreatic cancer, gastric cancer, and thyroid cancer.

Highlighted Results

Lung and Bronchus Cancer

Ten-year aggregated age-adjusted incidence and mortality rates for those under 50 in the Case CCC catchment area and in the U.S. at large are shown in **Table 1**. Compared with a national incidence rate of 2.9 per 100,000 population and a national mortality rate of 1.3 per 100,000, local incidence and mortality over the last decade of available data have been 4.1 (95% CI 3.9-4.4) and 2.0 (95% CI 1.9-2.2), respectively. In both instances, the fact that the catchment area 95% confidence interval does not encompass the national number indicates a statistically significant difference in local and national rates. That more Northeast Ohioans under 50 are diagnosed with and die of lung and bronchus cancer than their average counterparts in the rest of the U.S. is not surprising given the elevated smoking prevalence in the region. While 2025 national estimates put U.S. cigarette smoking prevalence at 11.6% of the adult population, 15.9% of adults living in the Case CCC Northeast Ohio catchment area are estimated to currently smoke cigarettes.²¹

Figure 1a compares the trajectories of lung and bronchus cancer incidence in the Case CCC catchment area and the US. While overall incidence is higher locally, local and national incidence have both been on a steady decline since around 2004. This decrease is widely believed to be attributable to declining smoking prevalence since the mid-1960's^{22,23}, a public health success story. **Figure 1b** depicts similar trends in local and US lung and bronchus cancer mortality.

Early Onset Cancer: 10-year average age-adjusted annual incidence per 100,000 (95%CI)		
Cancer Type	Catchment Area	U.S.
Lung & Bronchus	4.1 (3.9–4.4)	2.9
Obesity-related ¹	59.8 (58.8–60.8)	55.0
Colorectal ²	8.0 (7.6–8.3)	7.6
Female Breast	47.1 (45.8–48.4)	46.0
Prostate	3.9 (3.6–4.3)	3.7
Early Onset Cancer: 10-year average age-adjusted annual mortality per 100,000 (95%CI)		
Lung & Bronchus	2.0 (1.9–2.2)	1.3
Obesity-related ¹	7.3 (7.0–7.7)	7.0
Colorectal ²	1.9 (1.7–2.1)	1.8
Female Breast	4.5 (4.1–4.9)	4.1
Prostate	- - ³	0.1

Table 1 – 10-year age-adjusted average annual incidence and mortality rates for early onset (< age 50) cancers in the Case CCC area and the U.S. among four common cancer types and for a e group of obesity-related cancers

1. Cancers of the esophagus, breast (female), colorectum, uterus, gallbladder, stomach, kidney and renal pelvis, liver and intrahepatic Bile Duct, ovary, pancreas, and thyroid, as well as myeloma.²⁰

2. Excludes appendiceal cancers

3. Rate not shown (total deaths 10 or fewer)

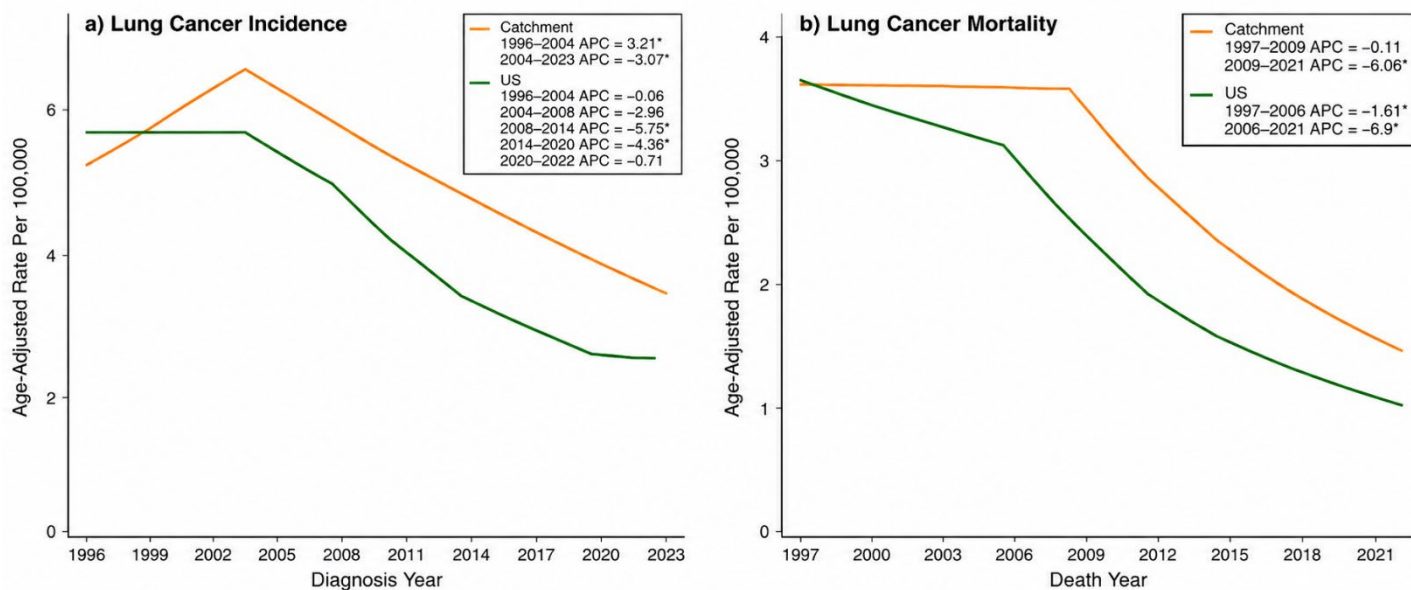


Figure 1 – Joinpoint regression results for Case CCC catchment area and U.S. age-adjusted lung and bronchus cancer a) incidence and b) mortality. Asterisks indicate annual percent changes (APC) differ significantly from 0 at alpha 0.05.

Obesity-related Cancers

Early onset obesity-related cancer incidence is also significantly elevated in the catchment area at an annual rate of 59.8 (58.8–60.8) new cases per 100,000 population relative to the national rate of 55.0 cases per 100,000. (Table 1). As with lung cancer, this finding follows logically from the substantially elevated local levels of obesity. While the national prevalence of adult obesity is 32.9%, the corresponding estimate for Northeast Ohio is 37.1%.²¹

Figure 2a depicts catchment and national trends in the incidence of early-onset obesity-related cancers. Both locally and nationally, incidence of these cancers is rising by around 1.5% per year on average. If we remove CRC from this group, we see a flattening of both the local and national incidence trends (a slope no different than zero) beginning in 2015 and 2014, respectively (**Figure 3a**).

Mortality from obesity-related cancers in those under age 50 is on the decline in both settings. Locally, the decline has occurred at a slightly faster (and borderline statistically significant) rate since 2009 (national APC from 2009–2021 of -0.65 versus a 1997–2021 local APC of -0.92, 95% -1.21 to -0.64); see **Figures 2b**. Mortality from obesity-related cancers excluding CRC exhibits a similar long-term decline locally and nationally (**Figure 3b**).

Colorectal Cancer

As a category of its own, early CRC cases and deaths are on the rise locally and nationally. Interestingly, when examining CRC in isolation, incidence and mortality both started at lower rates locally than nationally but ended at higher rates (**Figures 4a** and **4b**). The next few years may reveal whether these trends represent an actual stable pattern of local growth outpacing national growth versus local regression to a national mean.

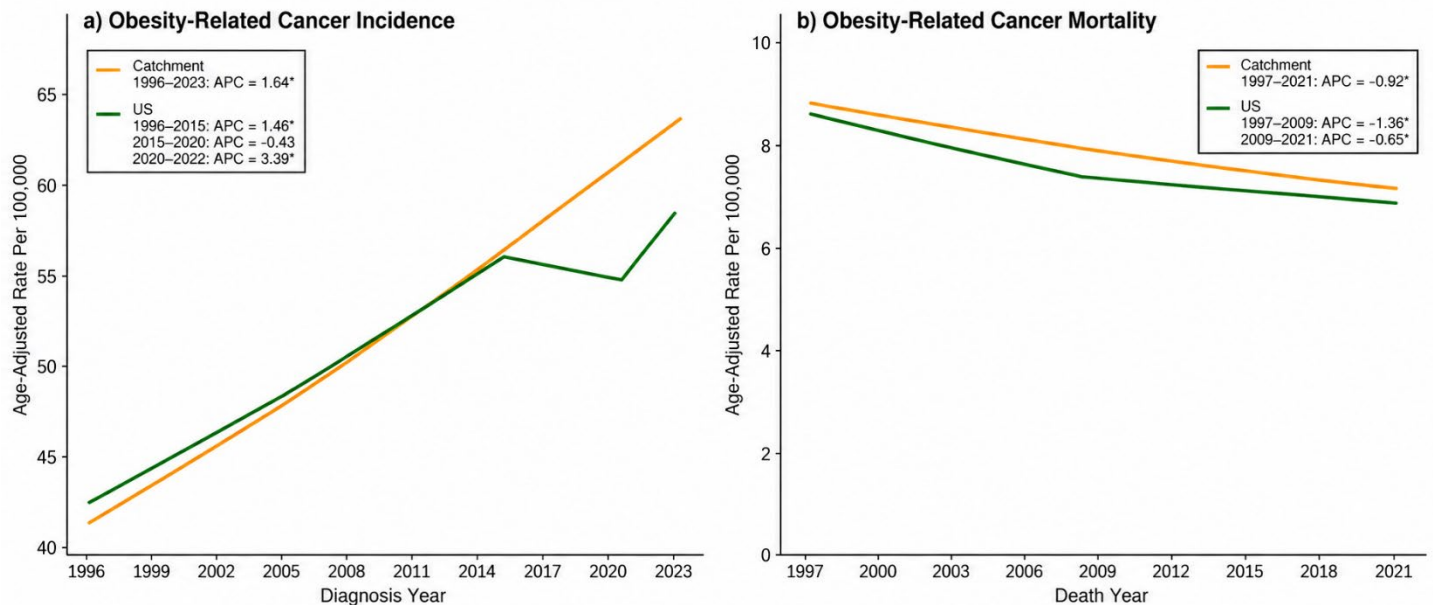


Figure 2 – Joinpoint regression results for Case CCC catchment area and U.S. age-adjusted obesity-related cancer (a) incidence and b) mortality. Asterisks indicate annual percent changes (APC) differ significantly from 0 at alpha 0.05.

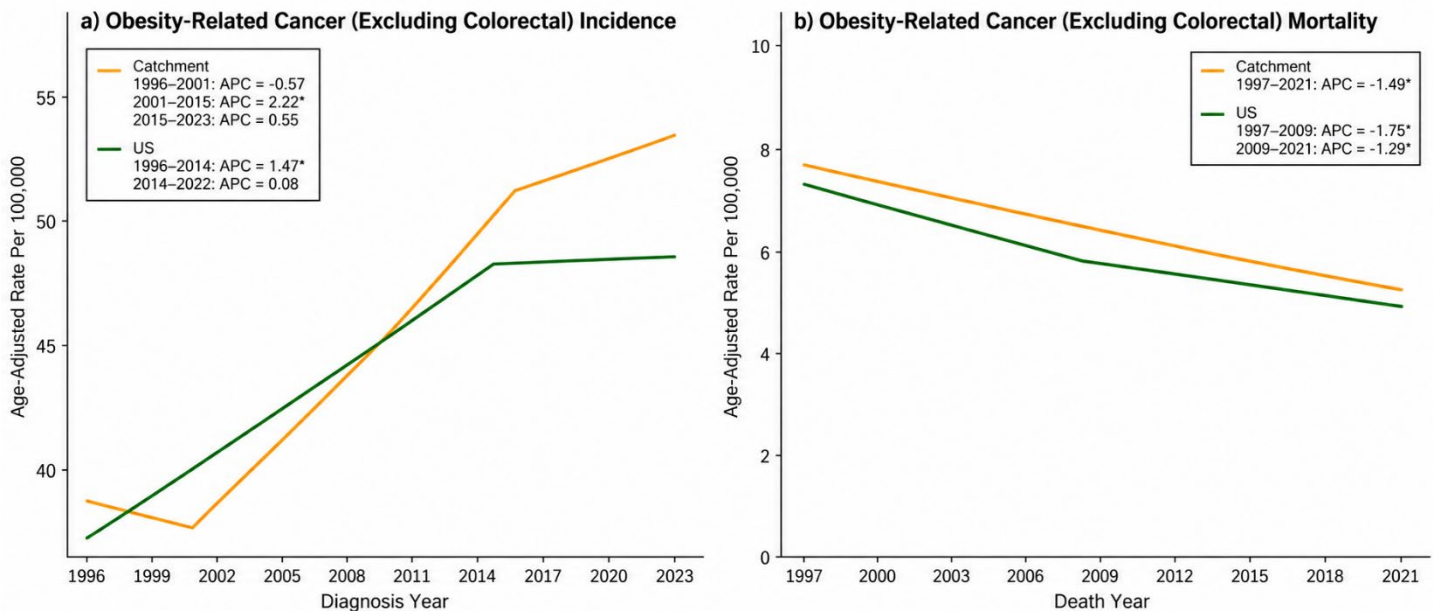


Figure 3 – Joinpoint regression results for Case CCC catchment area and U.S. age-adjusted obesity-related cancer (excluding colorectal) a) incidence and b) mortality. Asterisks indicate annual percent changes (APC) differ significantly from 0 at alpha 0.05.

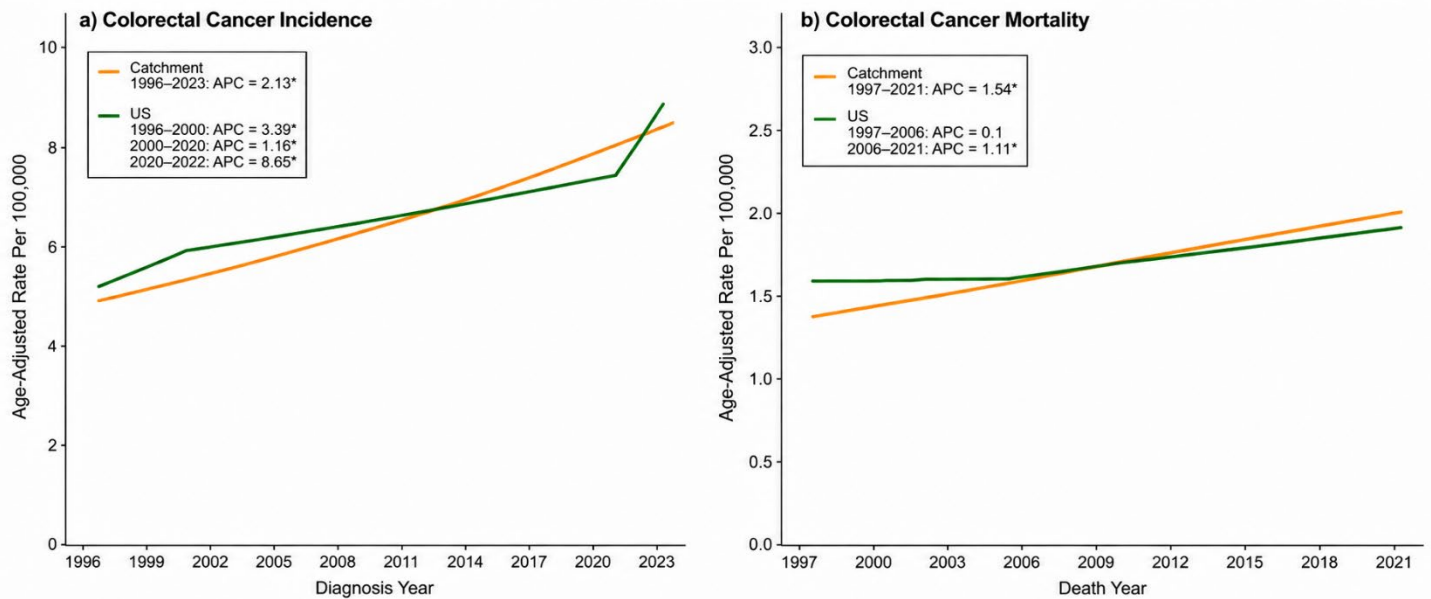


Figure 4 – Joinpoint regression results for Case CCC catchment area and US age-adjusted colorectal cancer a) incidence and b) mortality. Asterisks indicate annual percent changes (APC) differ significantly from 0 at alpha 0.05.

Female Breast Cancer

The 10-year average incidence of early onset breast cancer per 100,000 women has been slightly, though not statistically significantly, higher in the catchment area (47.1, 95% CI 45.8 to 48.4) than nationally (46.0). A similar pattern is seen in the mortality data, with 4.5 (4.1–4.9) deaths per 100,000 compared to 4.1 nationally. Incidence has seen a statistically significant rise locally and nationally in recent years (**Figure 5a**). At the same time, mortality has dropped at an annual rate averaging around 2% locally and nationally throughout the period examined.

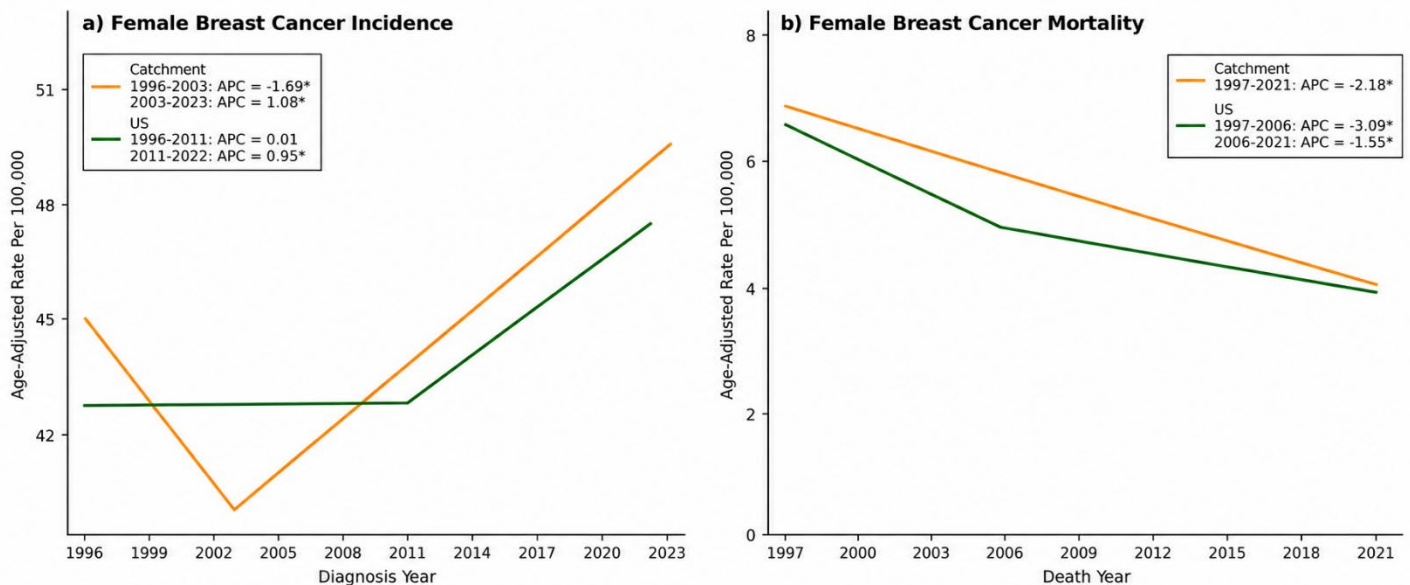


Figure 5 – Joinpoint regression results for Case CCC catchment area and U.S. age-adjusted female breast cancer a) incidence and b) mortality. Asterisks indicate annual percent changes (APC) differ significantly from 0 at alpha 0.05.

Prostate Cancer

10-year incidence of early onset prostate cancer in the catchment area and nation have been similar at 3.9 (95% CI 3.6–4.3) and 3.7 per 100,000 men, respectively. The mortality rate of men younger than 50 from prostate cancer is exceedingly low: 0.1 per 100,000 men nationally, with 10 or fewer deaths locally in a 10-year period. **Figure 6** depicts incidence over time. A key insight from the figure is that, after experiencing an increase in the first portion of the study period, incidence has been on the decline, corresponding with declining screening activity.²⁴

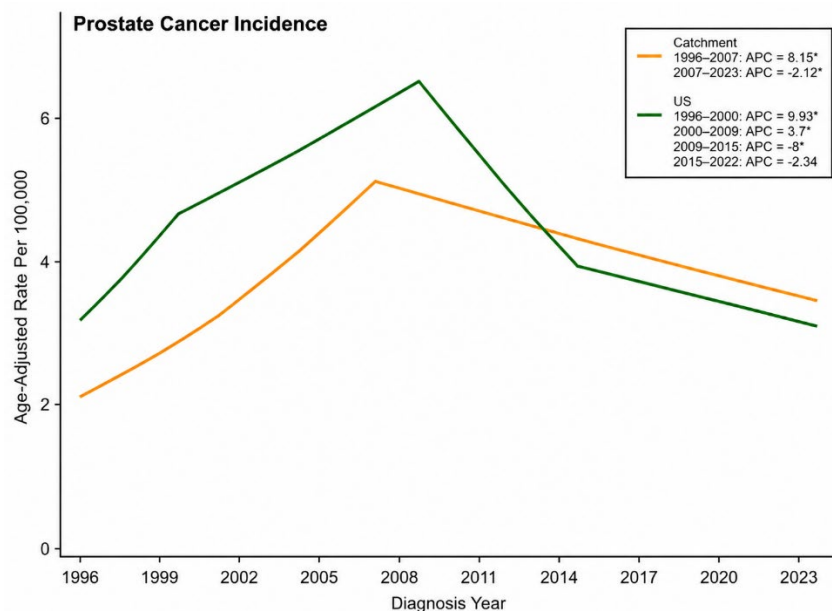


Figure 6 - Joinpoint regression results for Case CCC catchment area and U.S. age-adjusted prostate cancer incidence. Asterisks indicate annual percent changes (APC) differ significantly from 0 at alpha 0.05.

Discussion

The web of causality behind the rising cancer incidence in Americans younger than 50 is complex and likely heterogeneous across cancer types; but it appears to involve some combination of improved screening and diagnosis, dietary patterns, insufficient physical activity, rising obesity, and endogenous and exogenous hormone exposure. Here, we have compared the Case Comprehensive Cancer Center catchment area to the nation as a whole in terms of early onset cancer incidence, mortality, and the long-term trends therein.

Our findings show that

- Lung and bronchus cancer diagnoses and deaths in northeast Ohioans younger than 50 are significantly elevated relative to those of the nation as a whole. Fortunately, these rates are declining locally and nationally at a similar pace as smoking becomes less prevalent.
- Both obesity prevalence and incidence of early onset obesity-related cancers are substantially elevated relative to the nation as a whole. These cancers have been on the rise locally and nationally over the period examined, driven most recently by growth in early onset CRC incidence.
- Mortality of individuals under 50 from CRC has been on the rise, as early mortality from other obesity-related cancers steadily falls.
- Locally and nationally, early onset breast cancer incidence has been on the rise recently alongside rising screening uptake in younger women. At the same time, mortality has been on the decline.
- Locally and nationally, early onset prostate cancer incidence has fallen as screening recommendations have discouraged widespread screening.

These findings can inform both Case CCC's research agenda as well as its community outreach and engagement strategy. From a cancer perspective, tobacco and obesity are perhaps the two largest threats to residents of our catchment area. Work to develop and test community and clinical interventions to reduce the impact of these risk

factors can benefit catchment area residents, as can related outreach and education. The Case CCC community can also play a role in better understanding and combatting the rising incidence and mortality from early onset colorectal cancer. Finally, as early onset cancer continues to rise generally, population science which can inform risk stratification will move us closer to the reality of precision prevention in which high-risk younger adults are identified and screened according to their pre-test probabilities of cancer.

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*Have questions about this report or about the Case Comprehensive Cancer Center catchment area?
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