Overview of latest SEER data and the impact of COVID on cancer incidence trends and reporting

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Surveillance Research Program

April 20, 2023

NIH NATIONAL CANCER INSTITUTE

Speakers

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Overview of the latest SEER data and impact of COVID on cancer incidence trends and reporting

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SEER*Stat Tools Webinars

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50TH ANNIVERSARY SEER

Outline

- Impact of COVID on SEER cancer incidence data, statistics & reporting
- Highlights of the April, 19th 2023 data release
- Demo and highlights of trends and other statistics in SEER*Explorer
- Monthly cancer incidence rates during the first year of the COVID pandemic
- Q & A

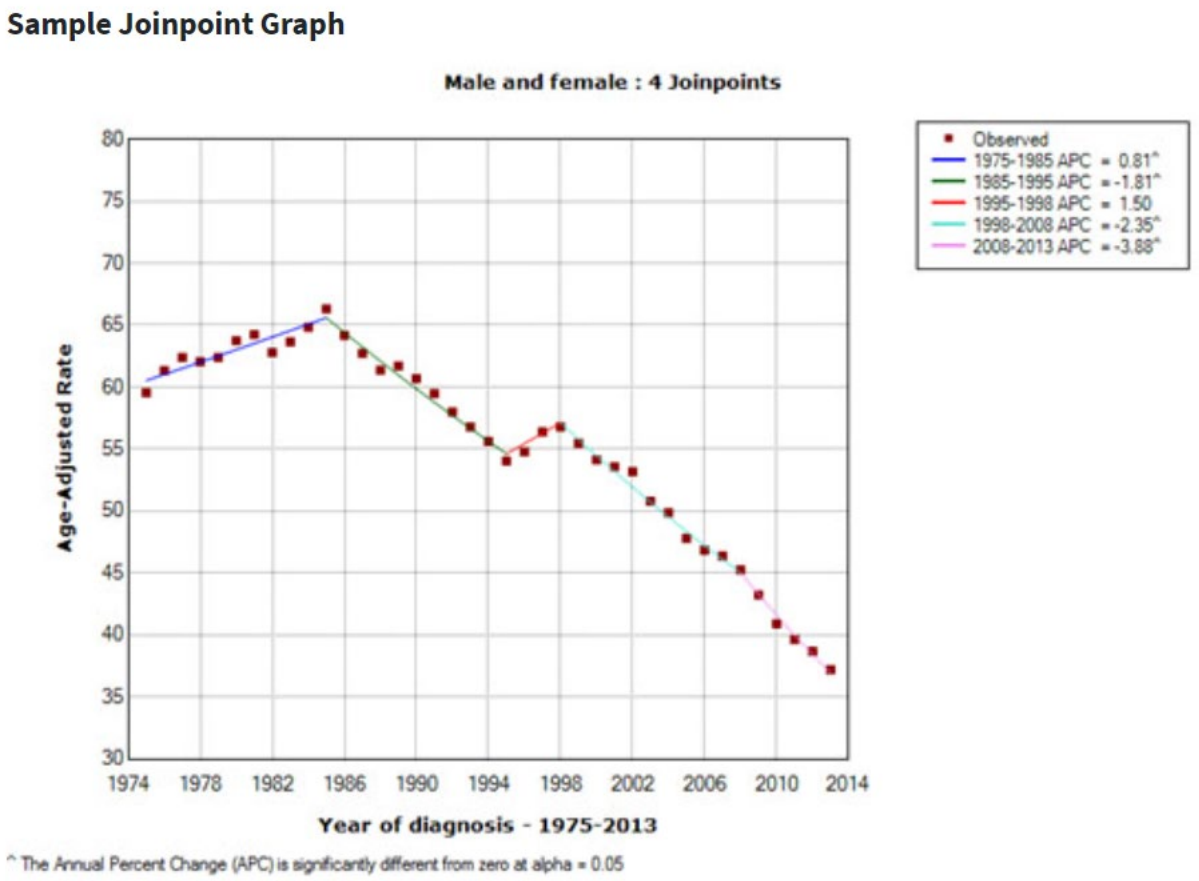
November 2022 SEER data submission

- The November 2022 SEER data submission includes new cancer cases diagnosed in 2020, the first year of the COVID-19 pandemic
- The impact of COVID on health services and the consequential delays and reductions in cancer screening and diagnosis led to a decline in the 2020 incidence rates
- Because 2020 is a temporary, **anomalous year caused by the pandemic**, it can bias estimates of substantive interest such as trends

Joinpoint Model

Joinpoints in 1985, 1995, 1998, and 2008

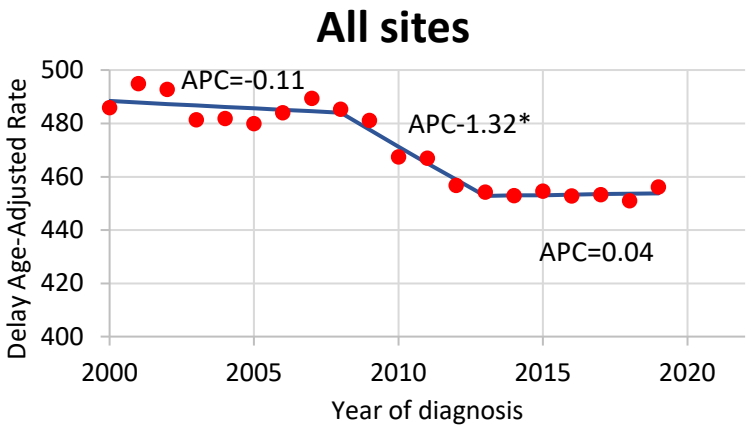
- Used to estimate trends in Reports
- Estimate calendar years when trends have changed → Joinpoints
- Summarizes trends between joinpoints → Annual percent change (APC)
- Challenge: Not designed to accommodate a one-year anomaly in data nor to estimate a change in one single calendar year



Challenges in using 2020 incidence data in Joinpoint model

- Inclusion of the 2020 incidence rate (outlier) can influence:
  - Location of joinpoints
  - Annual percent change (APC) measure
  - Provide poorer fit of the model and more error in the model
  - Create challenges in the interpretation of estimate's association with risk factors and efforts in prevention and early detection
- Illustrate issues using data for: all cancer sites combined, melanoma and prostate cancer

Nov. 2021 Submission Data: 2000-2019
(last year's)

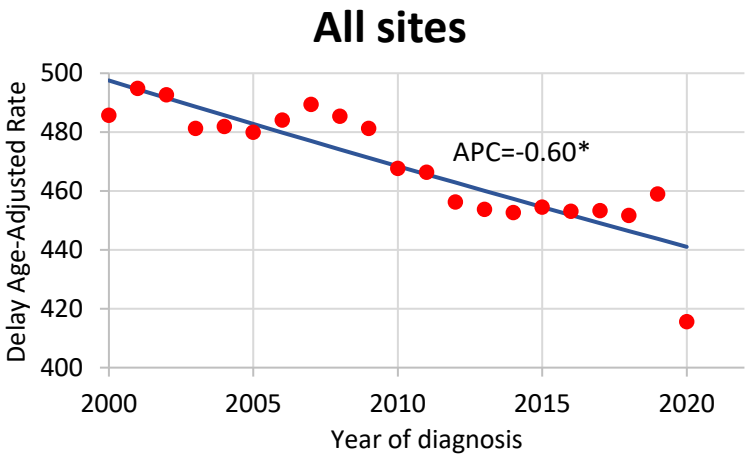


Joinpoints in 2008 and 2013

Message:

- Trend significantly declined between 2008-2013 by 1.32% per year
- Trend has been stable between 2013-2019

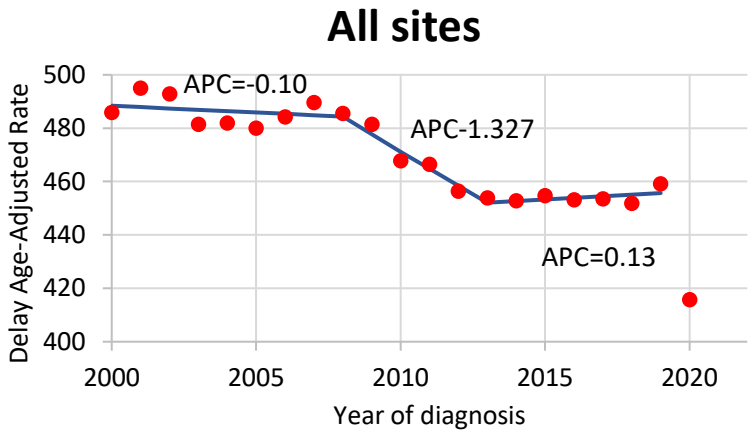
Nov. 2022 Submission Data: 2000-2020
This year data including 2020



Very poor fit of the model

Message: Trend has been declining at a constant rate of 0.6% per year since 2000

Nov. 2022 Submission Data: 2000-2019
This year data excluding 2020

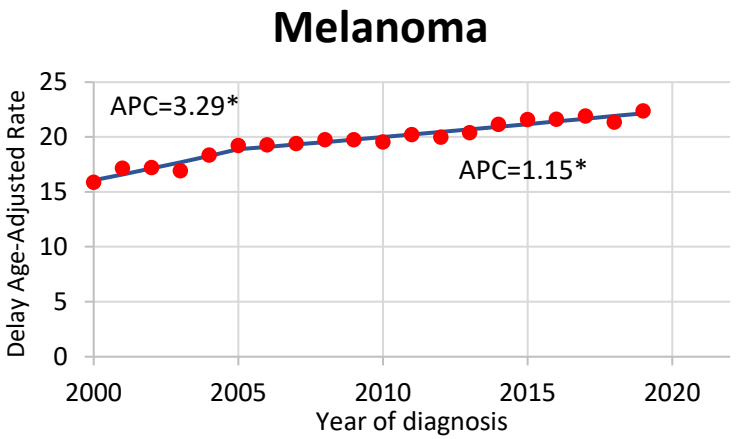


Joinpoints in 2008 and 2013

Message:

- Trend significantly declined between 2008-2013 by 1.37% per year
- Trend has been stable between 2013-2019

Nov. 2021 Submission Data: 2000-2019
(last year's)

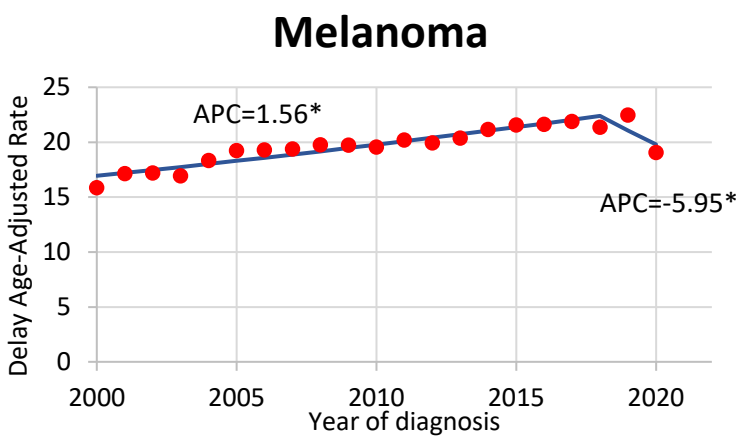


Joinpoint in 2005

Message:

- Trend has been significantly increasing from 2005 at 1.15% per year

Nov. 2022 Submission Data: 2000-2020
This year data including 2020

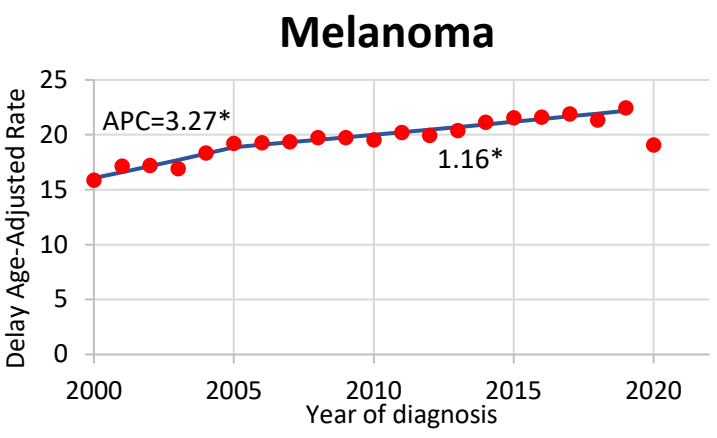


Joinpoint in 2018

Joinpoint in 2018

Message: Trend began to decline in 2018 at almost 6% per year???

Nov. 2022 Submission Data: 2000-2019
This year data excluding 2020

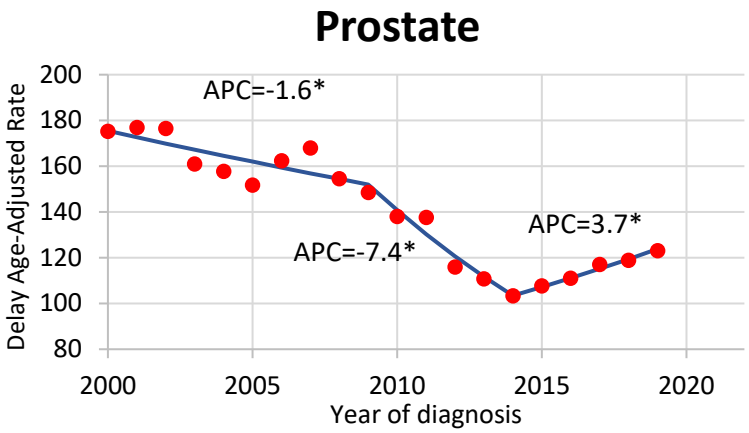


Joinpoint in 2005

Message:

- Trend has been significantly increasing from 2005 at 1.16% per year

Nov. 2021 Submission Data: 2000-2019
(last year's)

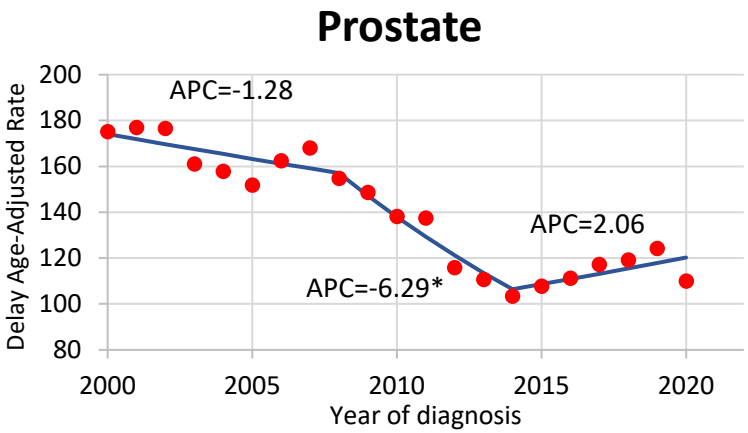


Joinpoints in 2009 and 2014

Message:

- Trend has been significantly increasing since 2014 at 3.7% per year

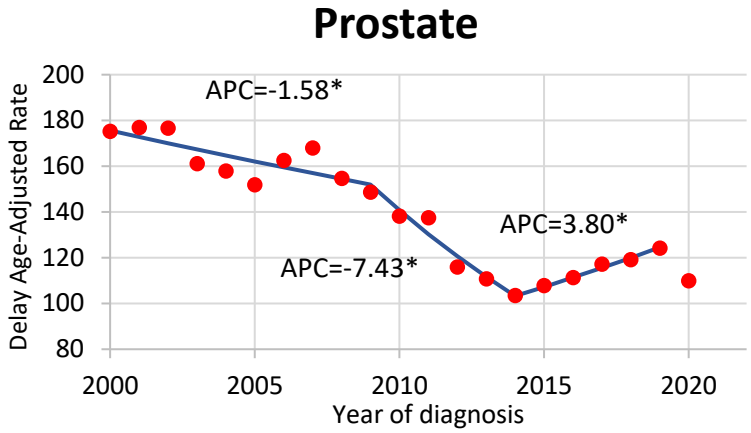
Nov. 2022 Submission Data: 2000-2020
This year data including 2020



Joinpoints in 2008 and 2014

Message: **The trend in 2014-2020 is not significantly increasing ???**

Nov. 2022 Submission Data: 2000-2019
This year data excluding 2020



Joinpoints in 2009 and 2014

Message:

- Trend has been significantly increasing from 2014 at 3.8% per year

2020 incidence data is

- **Excluded** from two cancer statistics:
  - Trend estimates using the joinpoint model
  - Risk of being diagnosed with cancer using the DevCan
    - Instead of using the cross–sectional incidence rates for 2018-2020 we are using 2017-2019
    - Using 2018-2020 incidence rates would correspond to someone living their entire lifetime under the pandemic-induced incidence rates
- **2020 incidence data is included all SEER*Stat databases** and all the other cancer statistics in SEER*Explorer, Stat Facts, and other web-based reports

https://seer.cancer.gov/data/covid-impact.html

https://seer.cancer.gov/data/covid-impact.html

Impact of COVID on 2020 SEER Cancer Incidence Data

The November 2022 SEER data submission includes new cancer cases diagnosed in 2020, the first year of the COVID-19 pandemic. In 2020, the highly publicized impact of COVID on health services and the consequential delays and reductions in cancer screening and diagnosis led to a decline in the 2020 incidence rates for most cancer sites.

Because 2020 was a temporary, anomalous year caused by the pandemic, it can bias estimates such as cancer incidence trends that are of substantive interest. To address the bias, SEER made some changes in the reporting of cancer statistics this year.

- The 2020 incidence data is included all SEER incidence databases and in most cancer statistics in SEER*Explorer, Stat Facts, and other web-based reports.
- The 2020 incidence data is **excluded** from two cancer statistics: estimation of Joinpoint trends and risks of developing cancer (DevCan).

The 2020 incidence cases are available in the SEER Research Data for analysis through SEER*Stat.

Exclusion of 2020 Incidence Data from Joinpoint Trends

The joinpoint regression model for the analysis of trends was not designed to accommodate a one-year anomaly in data nor to estimate a change in one single calendar year. Inclusion of the 2020 incidence can influence the location of joinpoints, the value of the trend measure (annual percent change), and provide a poor fit of the model and larger confidence intervals, challenging the interpretation of estimate's association with risk factors and efforts in prevention and early detection.

The joinpoint models used by SEER to report trends were fitted to the November 2022 data submission using rates through 2019. The 2020 incidence rates are included in statistical reports and displayed in graphs but are not used in the joinpoint model. Refer to an example from SEER*Explorer for Recent Trends in SEER Incidence Rate for All Cancer Sites, 2000-2020.

Exclusion of 2020 Incidence Data from Risks of Developing Cancer

For the November 2022 data submission, SEER uses 2017-2019 incidence rates instead of 2018-2020 to compute the risks of being diagnosed with cancer. Including 2020 in the estimates would correspond to someone living their entire lifetime under the pandemic-induced 2018-2020 incidence rates. Estimates of the risk of being diagnosed with cancer are calculated by applying cross-sectional, age-specific incidence rates and death rates to a hypothetical cohort of 10,000,000 live births. The probabilities of developing the specified cancer and dying of other causes (before developing the specified cancer) are calculated using multiple decrement life tables implemented in DevCan. The methods use the most recent 3-years to gain stability. For this reason, we have chosen to use 2017-2019 rather than 2018 through 2020 to compute the risks of being diagnosed with cancer.

Decline of 2020 Cancer Incidence Rates Relative to 2019 Rates

https://seer.cancer.gov/data/covid-impact.html

Cancer Site	2019 Delay-Adjusted Rate	2020 Delay-Adjusted Rate	Percent Change (PC)	95% Confidence Interval (Lower, Upper)
All sites	416.9	456.1	-9.3%	(-9.56%, -8.97%)
Breast (Females)	121.5	133.9	-9.6%	(-10.35%, -8.85%)
Colorectal	33.6	37.4	-10.7%	(-11.69%, -9.68%)
Kidney and Renal Pelvis	16.5	18	-9.5%	(-10.97%, -8.04%)
Leukemia	14.3	15	-5.7%	(-7.37%, -3.92%)
Lung	44.6	50.2	-11.9%	(-12.71%, -11.04%)
Melanoma of the Skin	19.1	22.4	-15.2%	(-16.43%, -13.90%)
Non-Hodgkin Lymphoma	17.8	19.1	-7.8%	(-9.20%, -6.31%)
Prostate	110.5	123.1	-11.2%	(-11.99%, -10.41%)
Urinary Bladder	17.3	18.4	-6.2%	(-7.68%, -4.75%)

- Percent change (PC) is calculated as

$$PC = \frac{[\text{rate (2020)} - \text{rate(2019)}]}{\text{rate(2019)}} = \frac{\text{rate (2020)}}{\text{rate(2019)}} - 1$$

- Both rates 2019 and 2020 are age-adjusted and adjusted for reporting delay

https://seer.cancer.gov/data/covid-impact.html

Survival Statistics

- Survival statistics in SEER reports do not include cases diagnosed in the last year of data
- This year is no exception and SEER*Explorer shows:
  - 5-year relative survival rates for cases diagnosed in 2012-2019
  - Trends, by time since diagnosis, conditional survival for cases diagnosed in 2000-2019
    - Trends still not available in SEER*Explorer, but will be available soon

Why survival statistics exclude cases in the last year of data

- The maximum length of survival for the last year is 11 months and not 1 year
- There is better ascertainment of deaths compared to alive status for cases diagnosed in the last year of data
  - Survival for cases diagnosed in the last year of data (2020) is underestimated

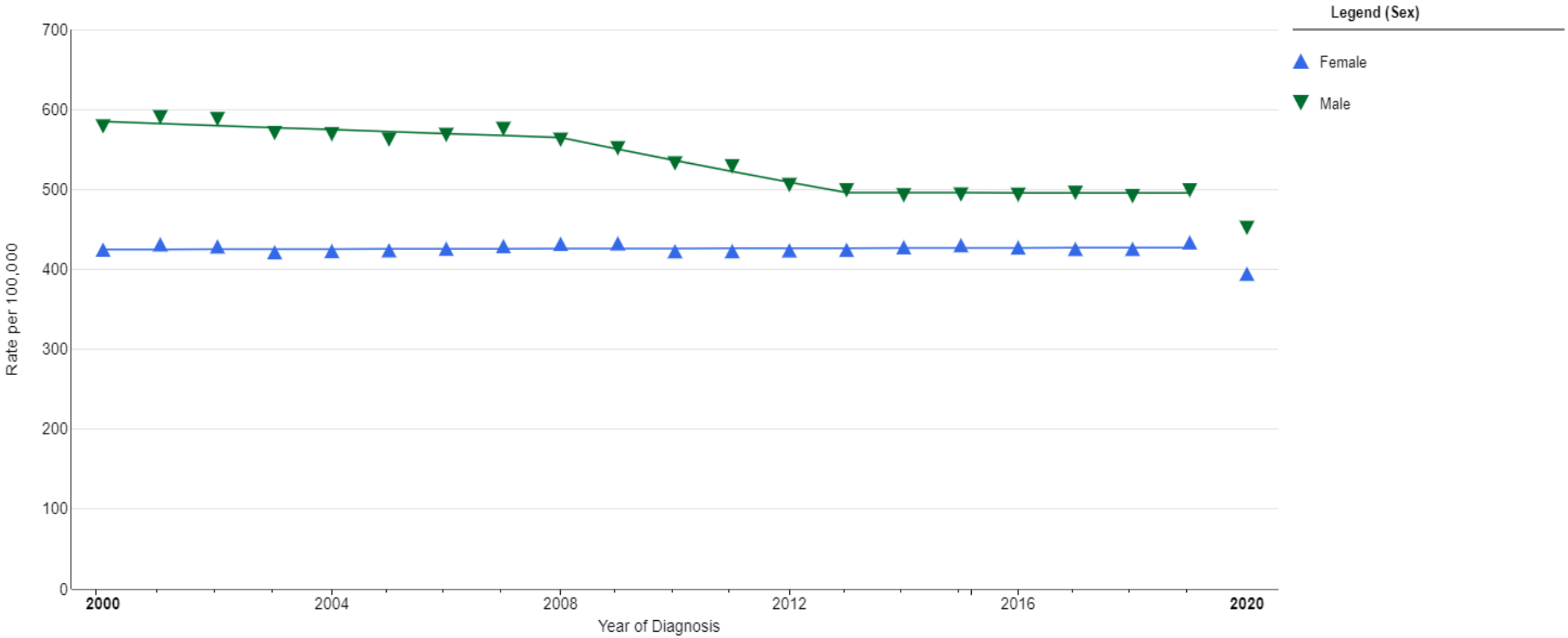
April 2023 Release Highlights

- Treatment variables are now available in Research databases (formerly only available in the Research Plus databases)
- New Variable for Race and Hispanic Origin: SEER now includes a system-supplied merged variable, "Race and origin (recommended by SEER)". It includes the five mutually exclusive race and ethnicity categories SEER uses for reporting cancer statistics
- Databases for survival calculations now include data from 3 newer registries:
  - Idaho, New York and Texas

Examples of Recent Trends in SEER Age-Adjusted Incidence Rates

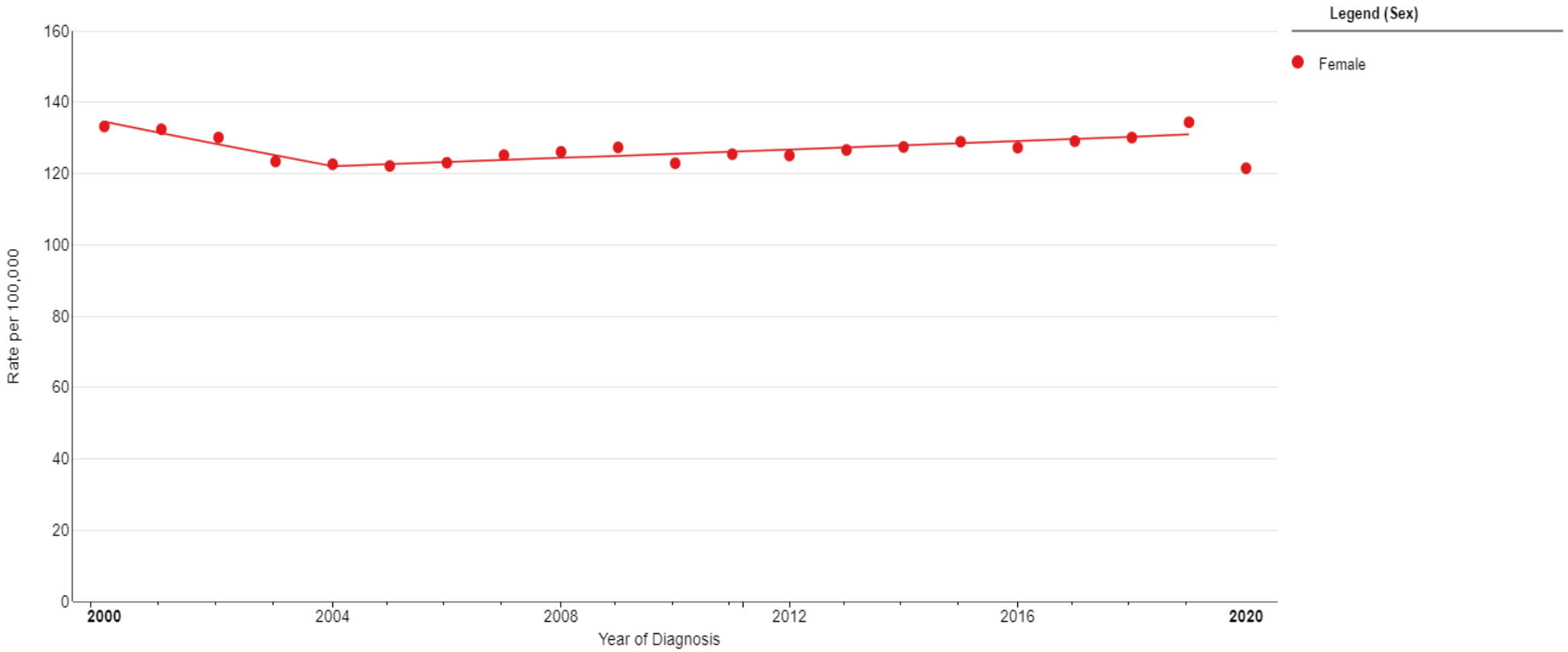
SEER*Explorer

All cancer sites combined



Created by https://seer.cancer.gov/statistics-network/explorer on Thu Apr 06 2023.

Breast cancer



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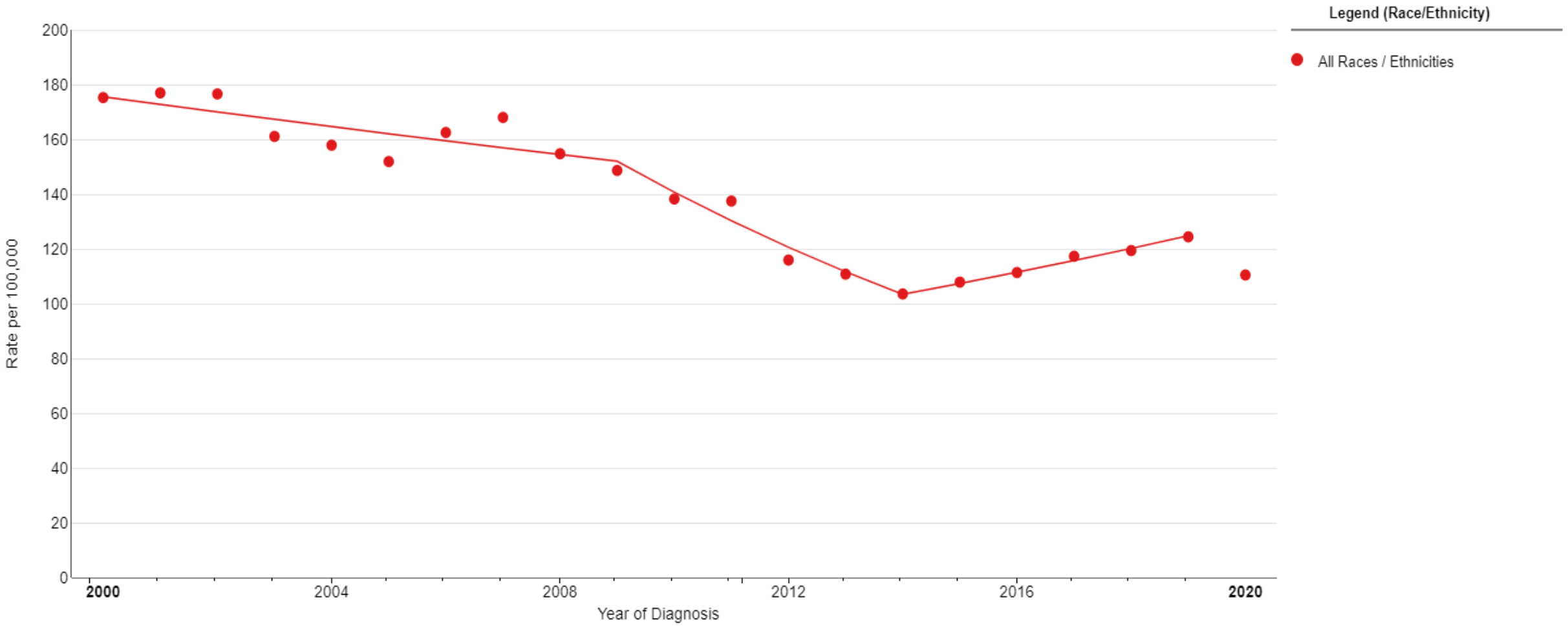
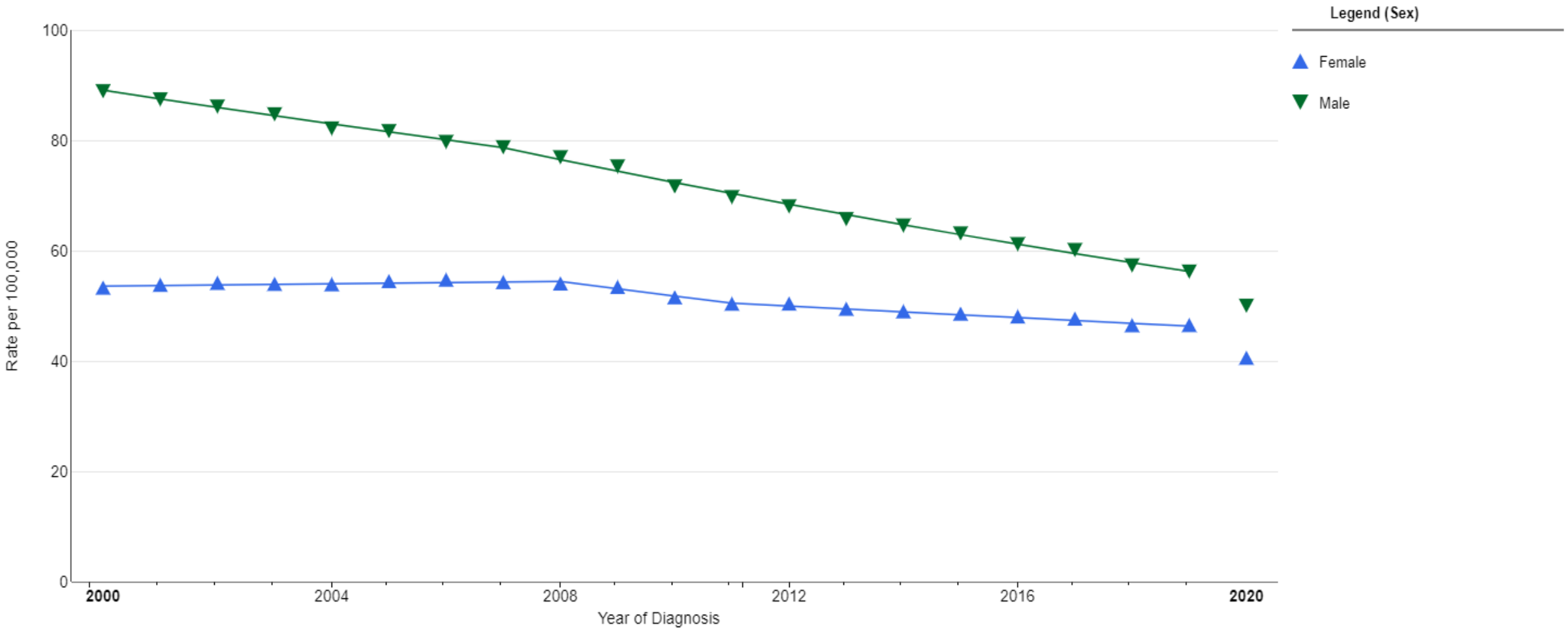
Prostate cancer



Created by https://seer.cancer.gov/statistics-network/explorer on Thu Apr 06 2023.

Lung cancer



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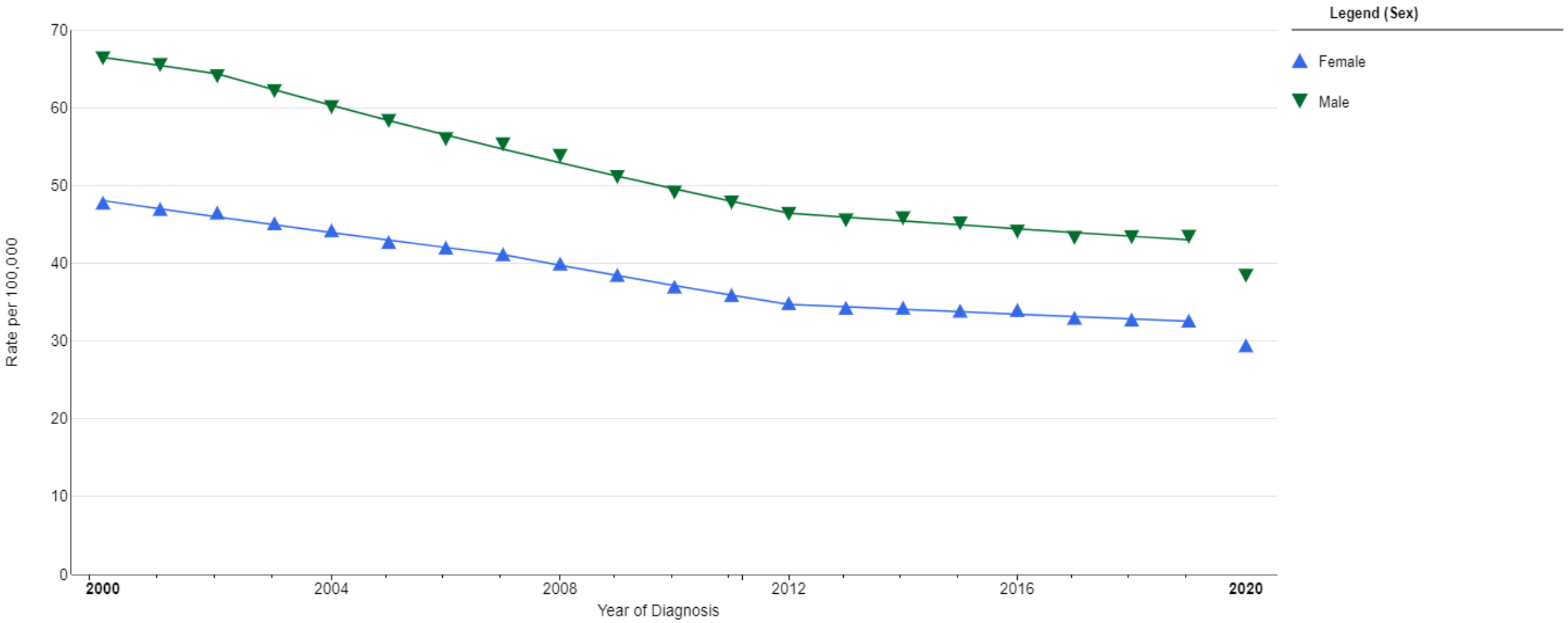
Colon and rectum



Created by https://seer.cancer.gov/statistics-network/explorer on Thu Apr 06 2023.

Other Statistics

SEER*Explorer

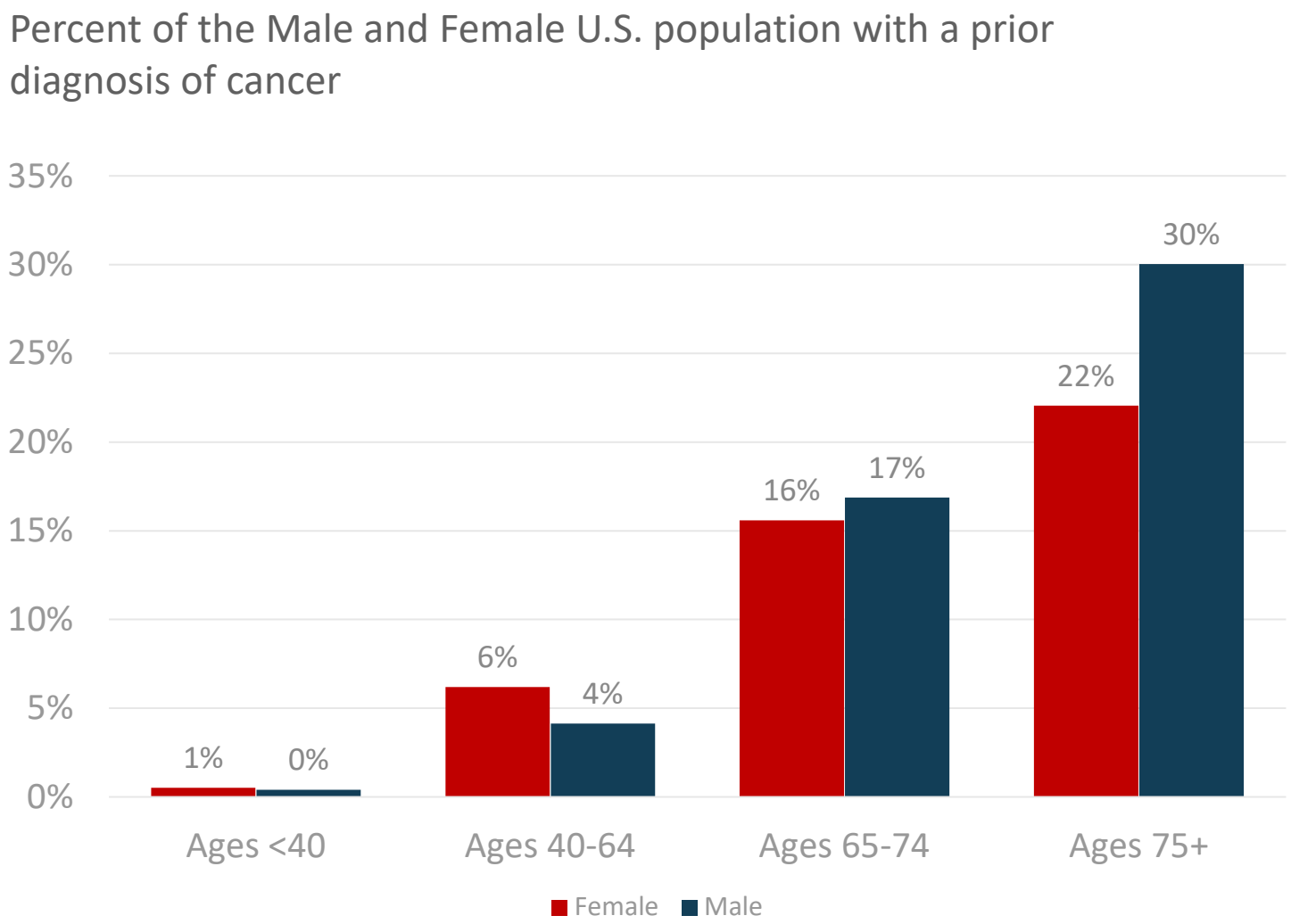
Prevalence Estimates at 1/1/2020

Cancer Site	Number of people alive with cancer at 1/1/2020	Percent of U.S. population	Percent change from 2019
All Cancer Sites Combined	17,113,494	5.20%	2.9%
Female Breast	3,886,830	2.33%	3.0%
Prostate	3,343,976	2.06%	2.8%
Melanoma of the Skin	1,413,976	0.43%	3.9%
Colon and Rectum	1,388,422	0.42%	1.4%
Thyroid	951,193	0.29%	3.9%
Corpus and Uterus, NOS	845,825	0.51%	2.8%
Non-Hodgkin Lymphoma	788,781	0.24%	3.3%
Urinary Bladder (Invasive & In Situ)	725,549	0.22%	1.8%
Kidney and Renal Pelvis	628,355	0.19%	4.9%
Lung and Bronchus	603,989	0.18%	4.7%
Leukemia	490,875	0.15%	3.8%
Oral Cavity and Pharynx	424,284	0.13%	3.4%
Cervix Uteri	296,981	0.18%	0.5%
Testis	291,294	0.18%	2.6%
Ovary	236,511	0.14%	1.3%
Hodgkin Lymphoma	223,512	0.07%	2.2%
Brain and ONS	180,047	0.05%	2.0%
Myeloma	170,405	0.05%	6.6%
Soft Tissue including Heart	163,898	0.05%	2.4%
Stomach	127,211	0.04%	2.7%
Liver and Intrahepatic Bile Duct	105,765	0.03%	5.3%
Pancreas	95,389	0.03%	6.9%
Larynx	89,649	0.03%	-0.6%
Esophagus	50,379	0.02%	2.6%

The percent for cancer sites that are sex-specific sites they % of the US population for that sex

16,627,949 in 1/1/2019

All Cancer Sites Combined
People Alive with Cancer (U.S. prevalence) on January 1, 2020
By Age at Prevalence and Sex



www.cancer.gov

www.cancer.gov/espanol

Cancer and COVID-19: US Cancer Incidence Rates During the First Year of the Pandemic

Nadia Howlader

Surveillance Research Program

SEER*Stat Tools Webinars

April 20, 2023

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Background

- The COVID-19 pandemic delayed medical care access in US
- Studies using U.S. cancer registry data showed substantial declines in the number of new cancer diagnoses in 2020*
- The key question remains: How did the COVID-19 pandemic affect cancer incidence rates in the US, and did it vary by key subgroups of interest?

*Negoita et al 2022, Yabroff et al 2022

Objectives

- **Report monthly cancer incidence rates during and prior-to the pandemic**
  - Estimate monthly incidence rates in 2020 and compare them to 2019 to assess impact of the pandemic on cancer incidence rates
  - Present estimates for all cancers combined and by type, for the overall population and for key demographic subgroups
- **Present annual incidence rates by cancer-stage to better understand how pandemic impacted disease severity**
  - Compare 2020 and 2019 incidence rates by stage

Methods

- **Analyzed SEER cancer cases in 22 registries, representing about 48 percent of the US population**
- **Calculated *monthly incidence rates* for 2019 and 2020**
  - For all cancers combined and by select cancer types (screening, symptoms, incidental and hematologic),
  - For the overall population and by demographic subgroups (gender, age at diagnosis, race and ethnicity, county-level measure of socioeconomic (<10% poverty, 10-<20% poverty, and >=20% poverty), and cancer registry location
- **Assessed incidence rates by cancer-stage**
  - Summary stage 2000 (in situ, localized, regional, distant)

Methods: Estimating monthly population to derive monthly cancer incidence rates

- Used the *Vintage 2020 p*opulation estimates projected from the 2010 census
  - Bridged race population estimate derived from original multiple race categories in the 2010 census
- Calculated population at risk in a given month based on annual county population estimates by age, gender, race, and Hispanic origin
- Cancer incidence rates were age-standardized to the 2000 US population in 5-year age groups

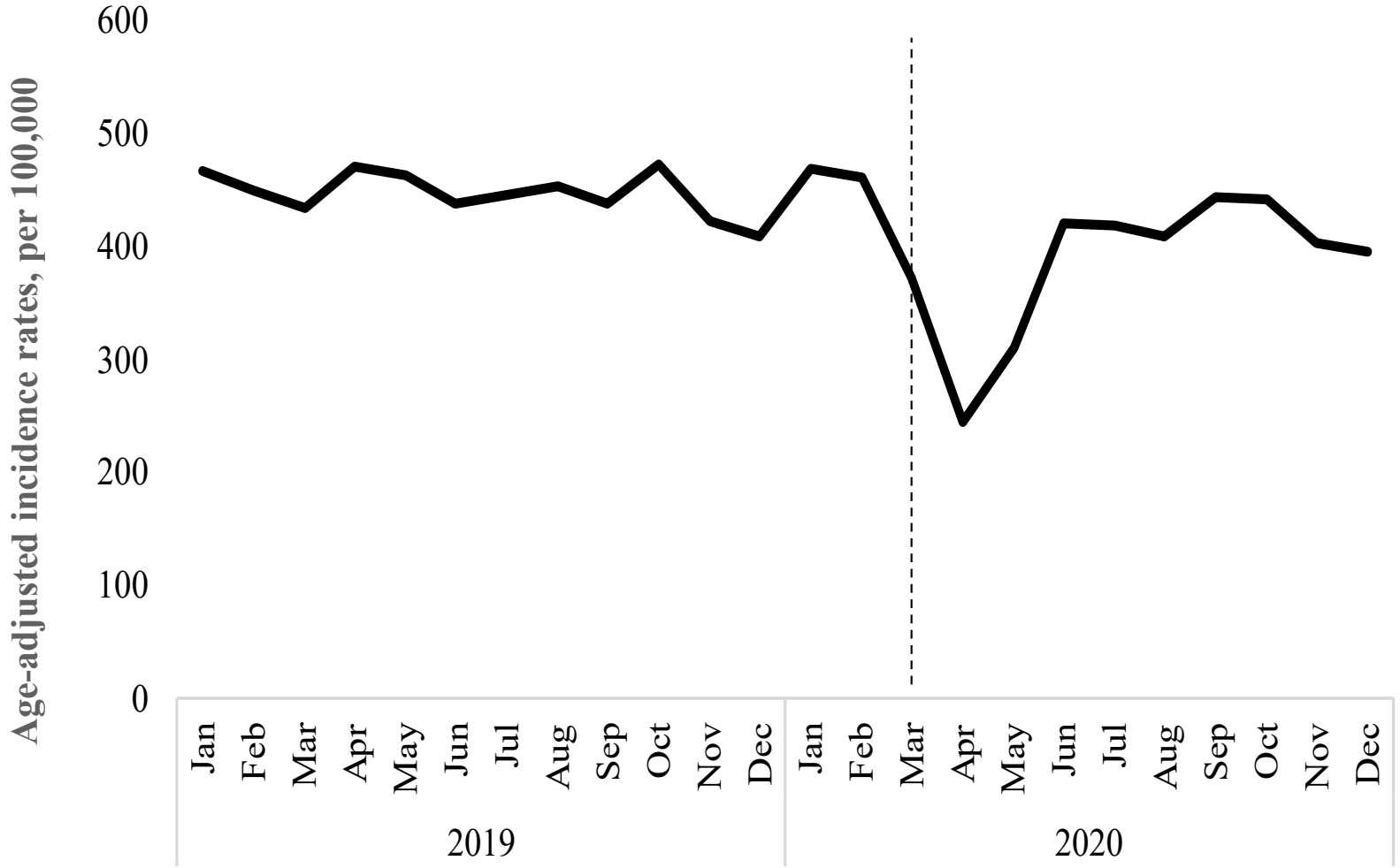
Methods: Defining Incidence Rate

$$\text{Incidence rate} = \frac{\text{Number of cases in a month}}{\text{Estimate of person-years at risk in a month}}$$

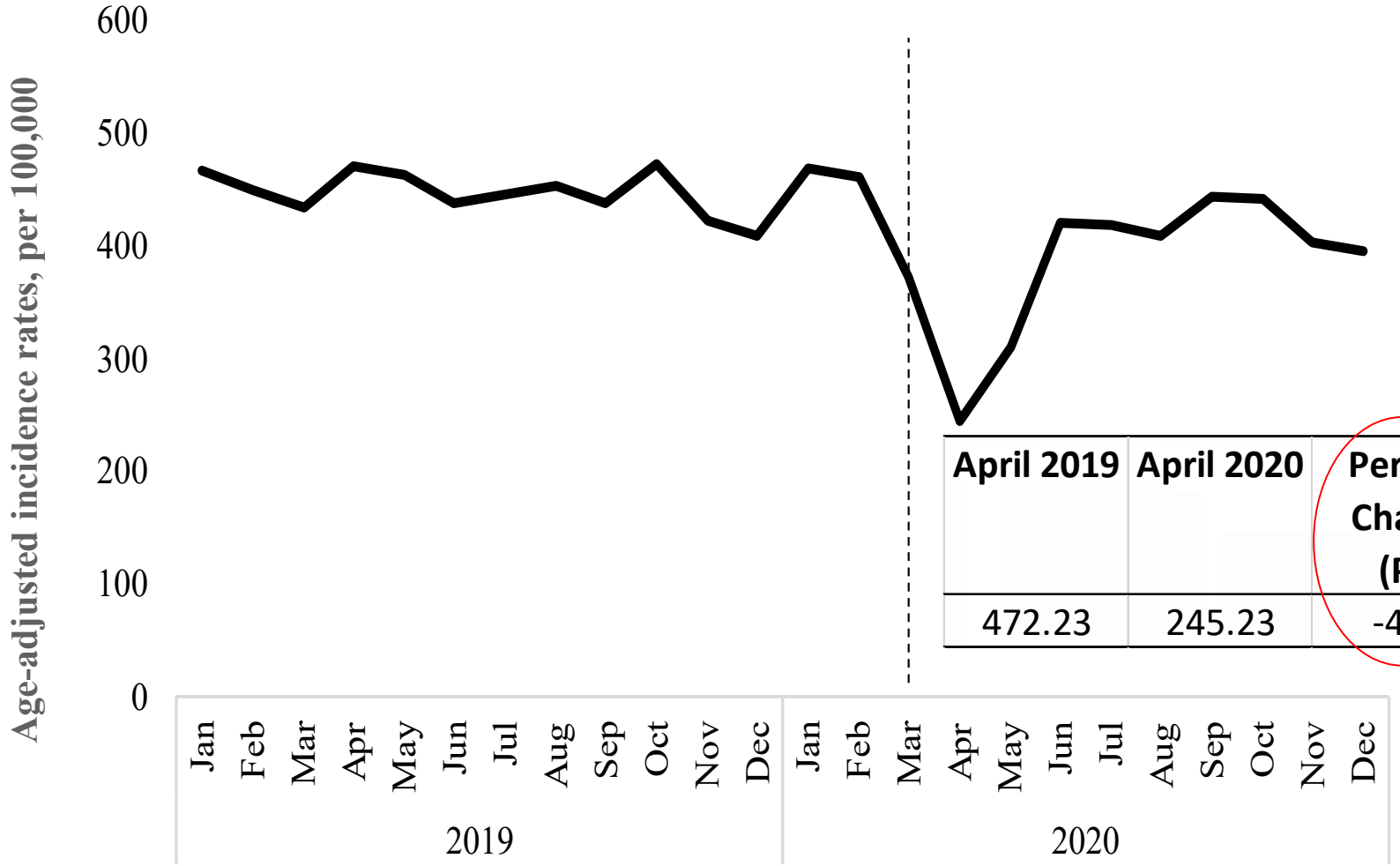
The rates represent number of cases per 100,000 persons

Results

All Cancer Sites Combined, SEER-22



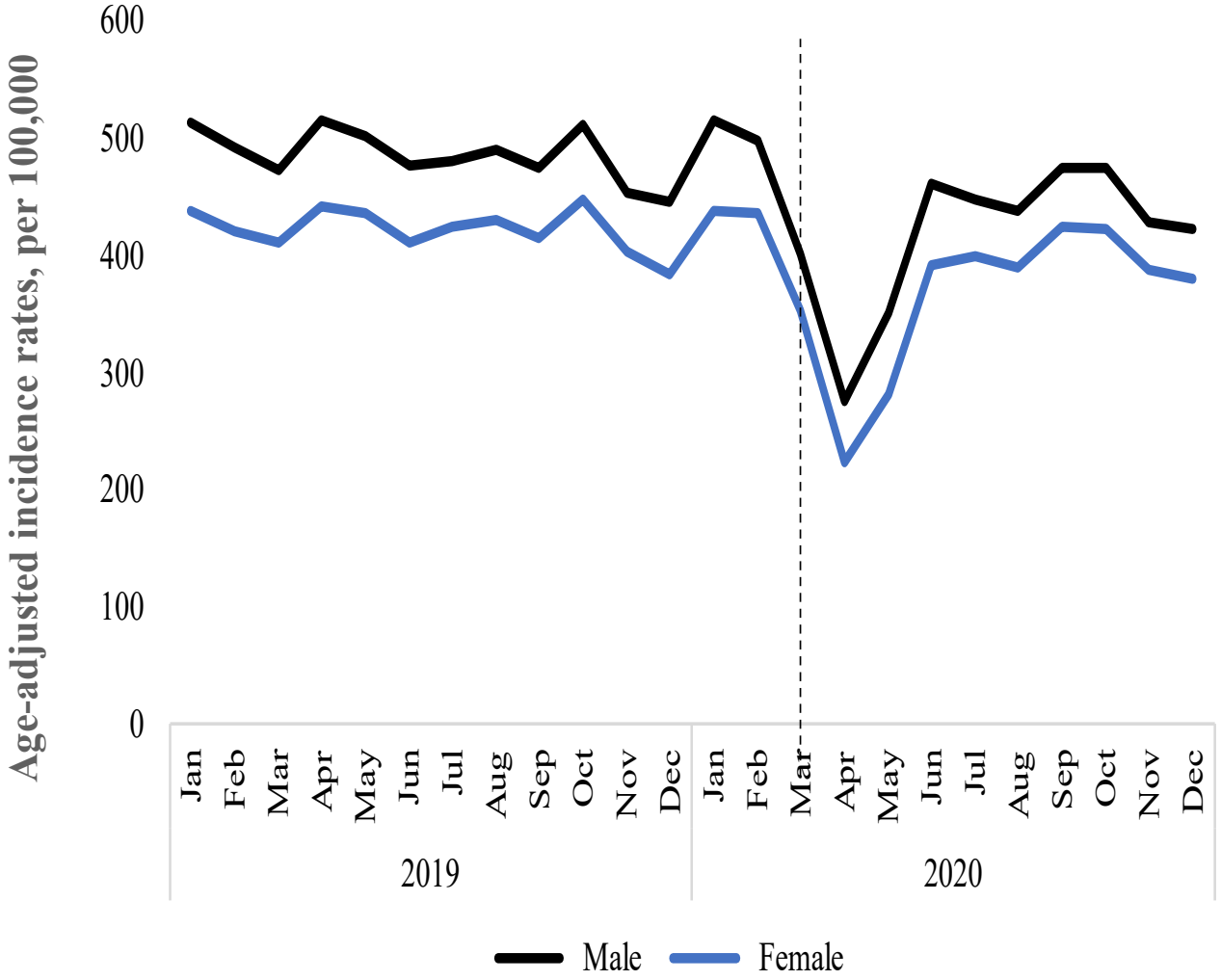
All Cancer Sites Combined, SEER-22



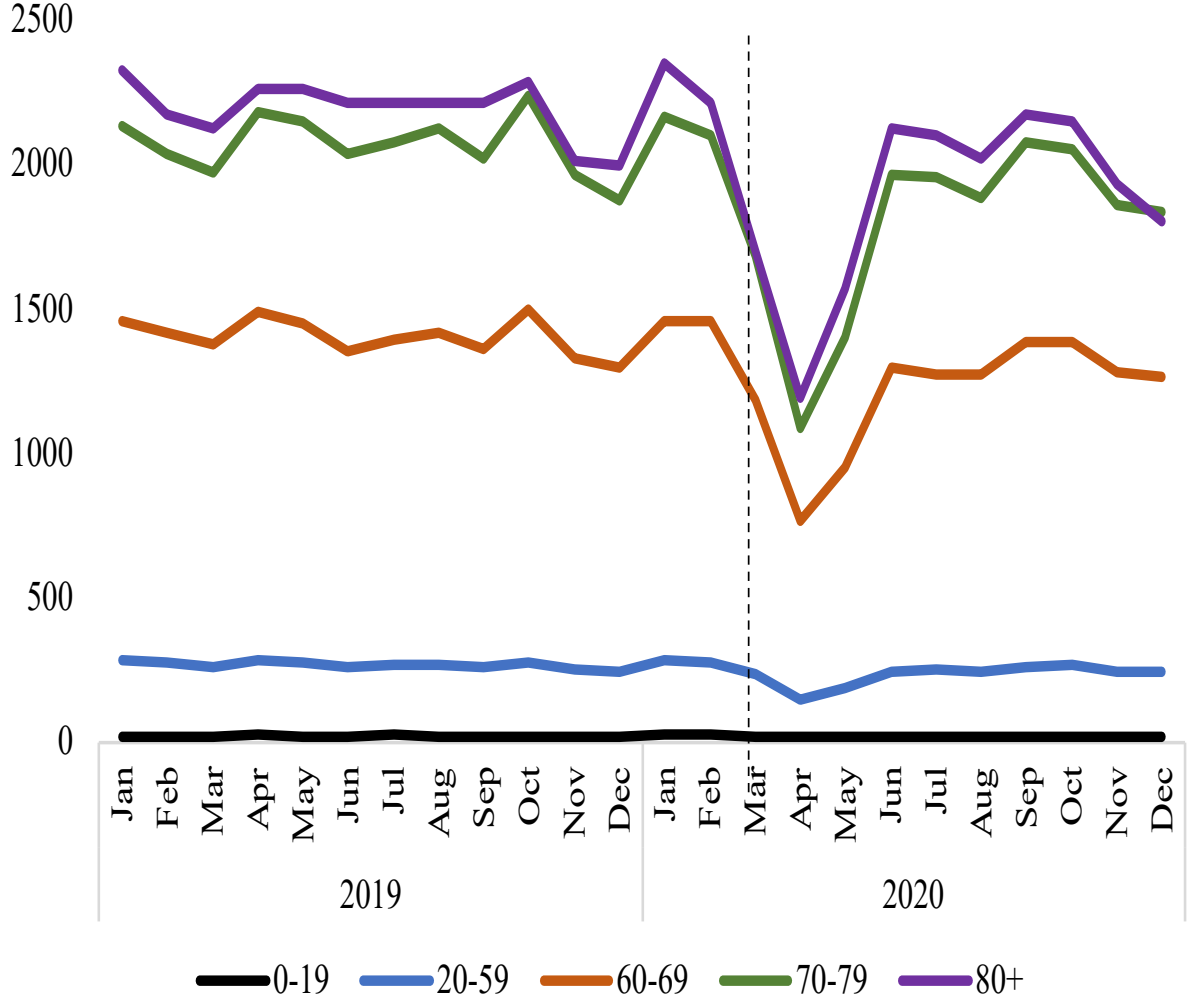
April 2019	April 2020	Percent Change (PC)	% Lower CI	% Upper CI
472.23	245.23	-48%	-47%	-49%

Demographic Subgroups: All Cancers Combined, SEER-22

Gender



Age at Diagnosis



Gender and Age: All Cancers Combined, SEER-22

	2019 April	2020 April	Percent Change (PC)	% Lower CI	% Upper CI
Gender					
Male	517	276	-47%	-46%	-48%
Female	442	223	-49%	-49%	-50%
Age					
0-19	21	14	-34%	-26%	-42%
20-59	281	149	-47%	-46%	-48%
60-69	1488	765	-49%	-47%	-50%
70-79	2176	1090	-50%	-49%	-51%
80+	2264	1193	-47%	-46%	-49%

Demographic Subgroups: All Cancers Combined, SEER-22

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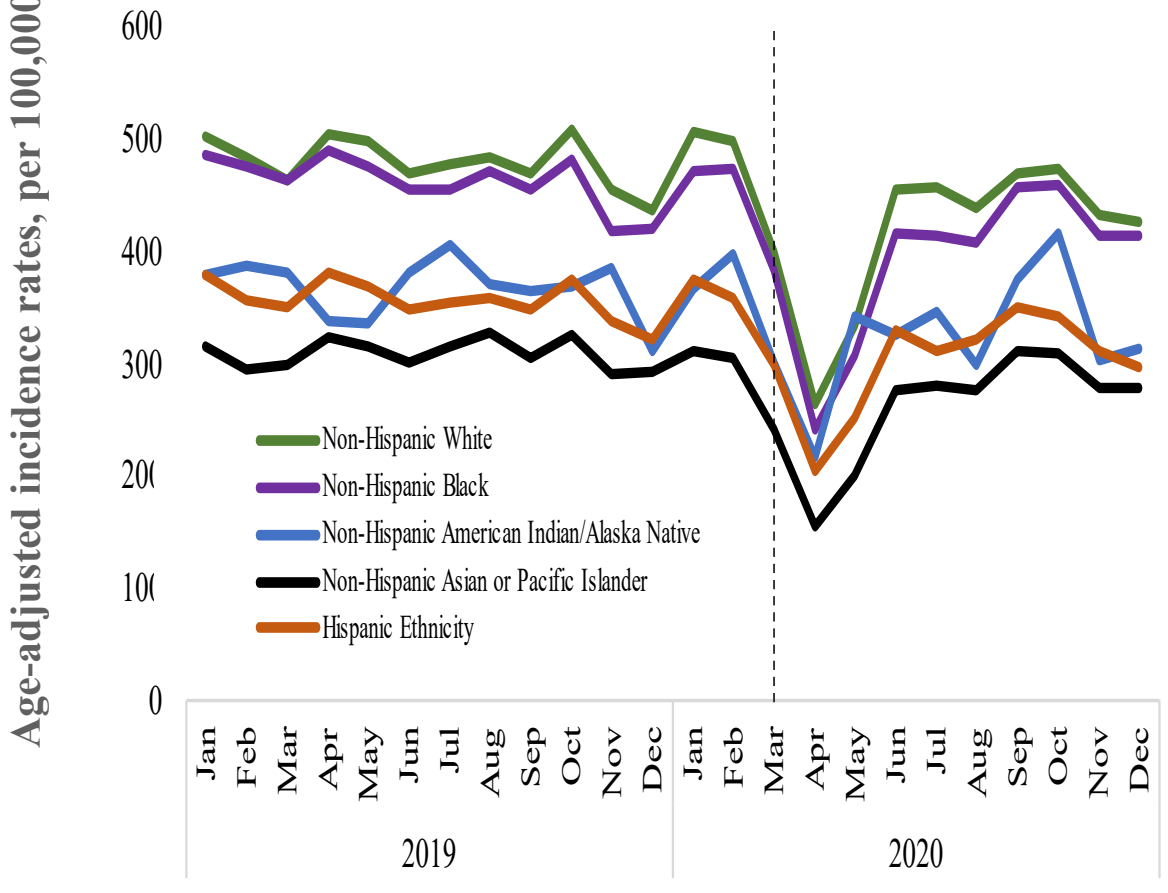
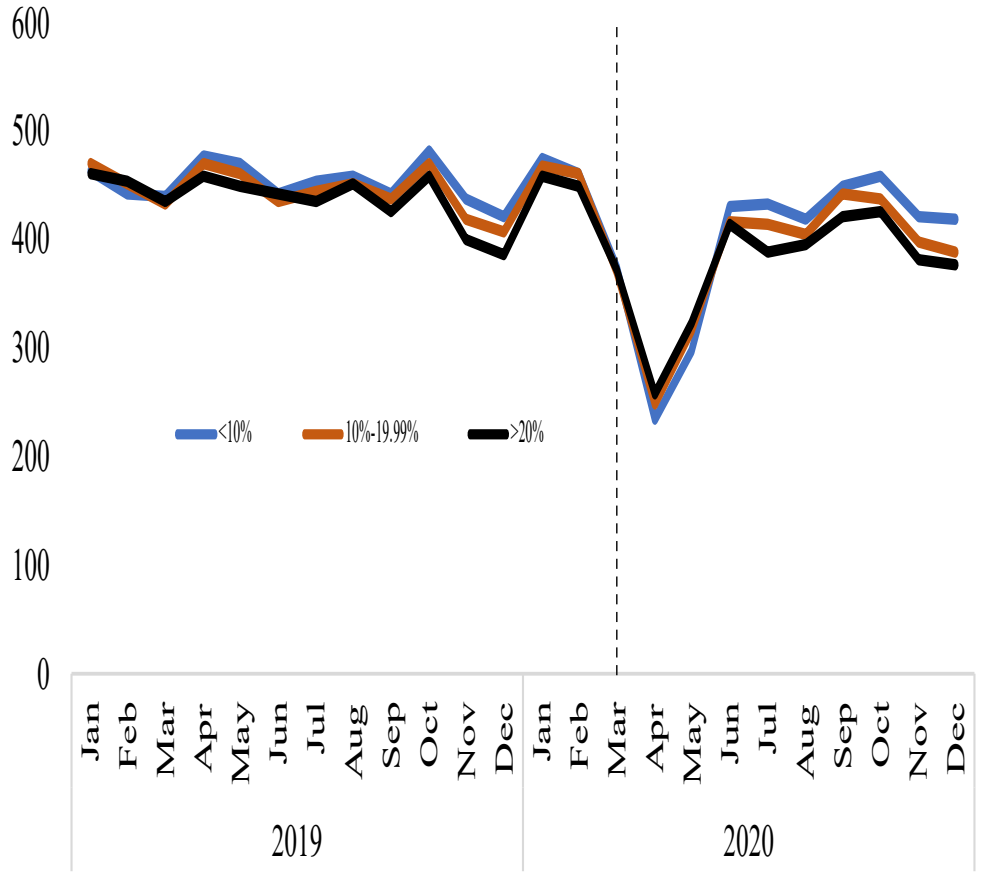
Race-ethnicities



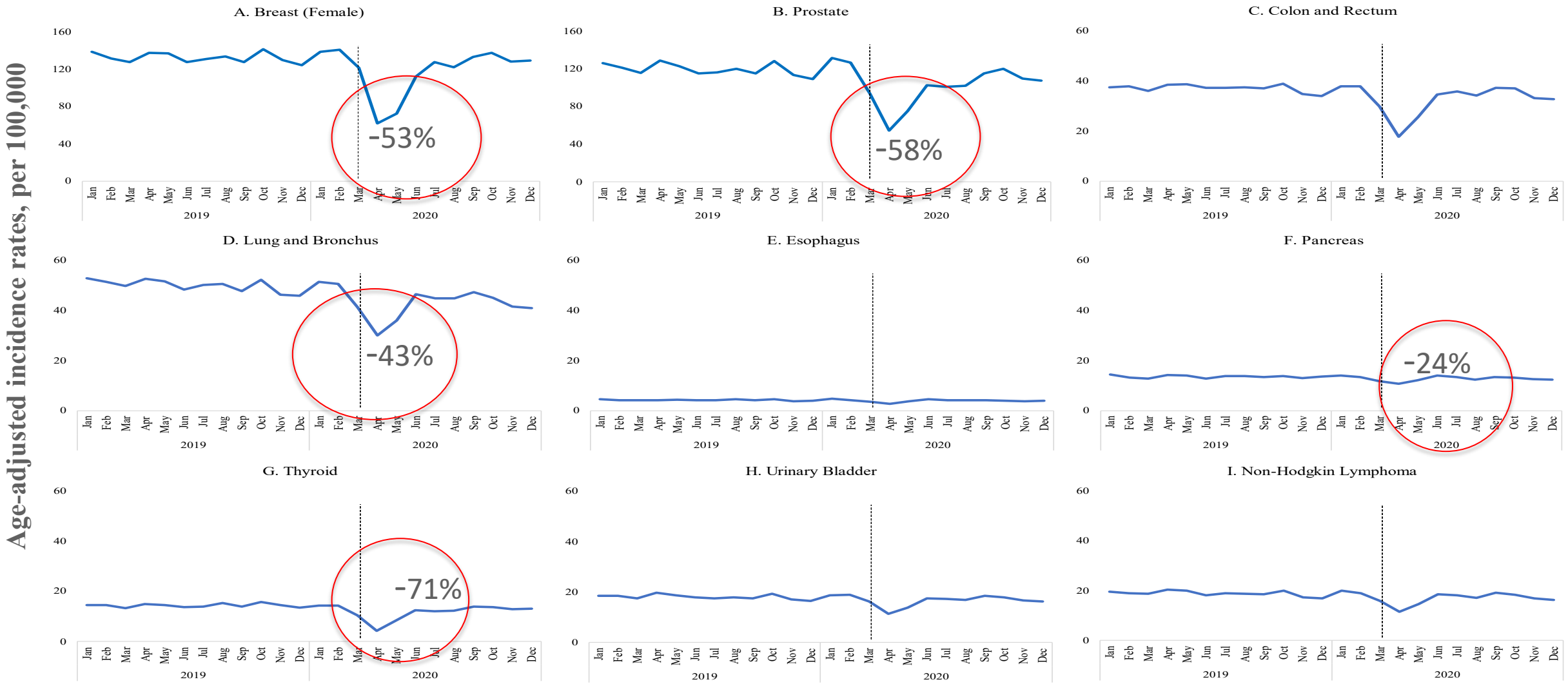
County level poverty



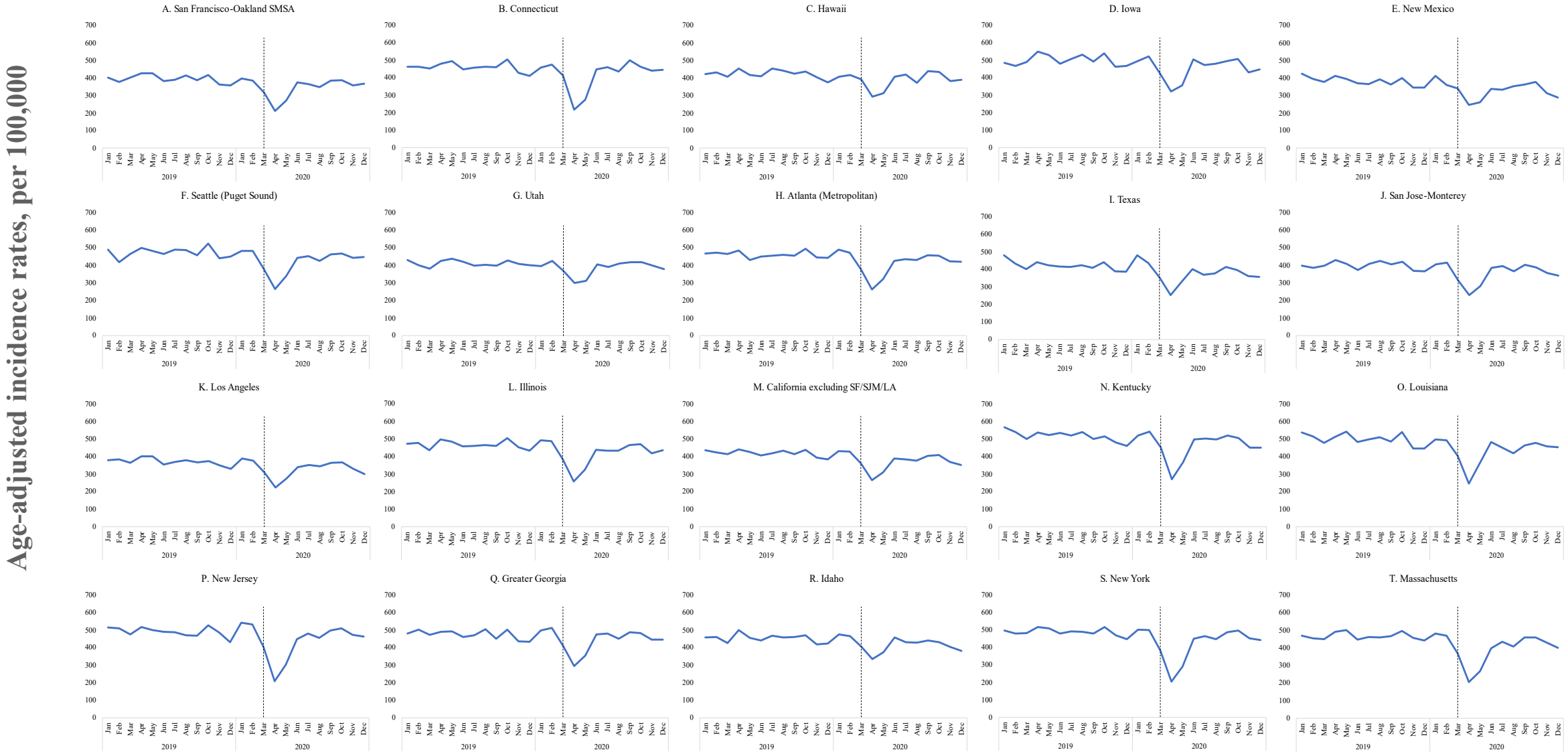
Demographic Subgroups : All Cancers Combined, SEER-22

	2019 April	2020 April	Percent Change (PC)	% Lower CI	% Upper CI
Race/Ethnicity					
Non-Hispanic White	505	264	-48%	-47%	-49%
Non-Hispanic Black	490	242	-51%	-49%	-53%
Non-Hispanic AI/AN	338	217	-36%	-22%	-47%
Non-Hispanic API	324	154	-52%	-50%	-55%
Hispanic	382	204	-47%	-45%	-48%
County level poverty					
poverty <10%	478	234	-51%	-50%	-52%
poverty 10%-19.99%	471	248	-47%	-46%	-48%
poverty >20%	460	259	-44%	-41%	-46%

Cancer Type, SEER-22



Registry: All Cancers Combined, SEER-22



Registry	2019 April	2020 April	Percent Change (PC)	% Lower CI	% Upper CI
Atlanta (Metropolitan)	483	261	-46%	-41%	-51%
California excluding SF/	439	265	-40%	-38%	-42%
Connecticut	478	218	-54%	-50%	-58%
Greater Georgia	490	294	-40%	-36%	-43%
Hawaii	453	292	-36%	-27%	-43%
Idaho	499	334	-33%	-25%	-40%
Illinois	498	257	-48%	-46%	-50%
Iowa	550	321	-42%	-37%	-46%
Kentucky	535	270	-50%	-46%	-53%
Los Angeles	400	222	-45%	-42%	-48%
Louisiana	512	245	-52%	-49%	-56%
Massachusetts	491	206	-58%	-55%	-61%
New Jersey	516	208	-60%	-57%	-62%
New Mexico	411	247	-40%	-33%	-46%
New York	515	205	-60%	-59%	-62%
San Francisco-Oakland	427	212	-50%	-46%	-54%
San Jose-Monterey	429	229	-47%	-41%	-52%
Seattle (Puget Sound)	498	265	-47%	-43%	-50%
Texas	439	253	-42%	-41%	-44%
Utah	424	299	-30%	-22%	-36%

Stage at Diagnosis
2020 vs 2019

Stage at Diagnosis and Cancer type, SEER-22

Cancer Type	Stage at Diagnosis	2019 Age-adjusted Rate	2020 Age-adjusted Rate	Percent Change (PC)	% Lower Confidence Interval PC	% Upper Confidence Interval PC
Female Breast	In Situ	31.63	27.23	-14%	-12%	-15%
	Localized	86.22	76.11	-12%	-11%	-13%
	Regional	34.96	31.95	-9%	-7%	-10%
	Distant	7.66	7.34	-4%	-1%	-7%
Prostate	Localized	81.77	68.54	-16%	-15%	-17%
	Regional	15.77	13.50	-14%	-12%	-16%
	Distant	10.51	10.07	-4%	-1%	-7%
Colon and Rectum	Localized	12.93	10.63	-18%	-16%	-19%
	Regional	13.32	12.20	-8%	-7%	-10%
	Distant	8.18	7.68	-6%	-4%	-8%
Lung and Bronchus	Localized	13.87	11.79	-15%	-13%	-17%
	Regional	10.07	8.37	-17%	-15%	-19%
	Distant	22.61	20.37	-10%	-9%	-11%

Key Takeaways

- Incidence rates declined the highest for thyroid cancer, followed by screen detected cancers during March to May 2020 (compared to 2019)
  - While incidence rates recovered after the sharp drop, they neither rebounded (nor surpassed) to the pre-pandemic levels
- Decline is modest for cancer types that are detected by symptoms (e.g., pancreatic cancer)
- The largest decline in incidence rates were seen in more affluent counties
- Ongoing evaluation of trends will be important to understand long-term impacts of the pandemic on stage at diagnosis, survival, and mortality

Thank You!

https://seer.cancer.gov/news/seerstat-webinars.html