

Cancers Associated with Human Papillomavirus in Ohio

August 2023

Introduction

Human papillomavirus (HPV), a group of more than 200 related viruses, is the most common sexually transmitted disease. More than 90% of sexually active men and 80% of sexually active women will be infected with HPV in their lifetime. HPV can be easily spread through direct sexual (vaginal, anal, and oral) contact, from the skin and mucous membranes of infected people to the skin and mucous membranes of their partners. Some types of HPV, including high-risk HPV types 16 and 18, have been linked to cancer in both men and women. In most people, HPV infections are asymptomatic and cleared from the body within one to two years. In some cases, however, the infection persists or returns. Persistent infections with high-risk HPV types can lead to cell changes that, if untreated, may progress to cancer. In the United States, high-risk HPV causes 3% of all cancers in women and 2% of all cancers in men.

An HPV-associated cancer is a microscopically confirmed cancer of the following sites/types: carcinoma of the cervix and squamous cell carcinomas of the anus, vagina, oropharynx, vulva, and penis. The site and histology codes for these six HPV-associated cancers are shown in Table 4 on page 28 of this report.

In this report, the following are highlighted: HPV infection prevention; HPV vaccination in Ohio and the United States; HPV-associated cancer incidence rates in Ohio by sex, race, age, county, and geographic region (rural/partially rural/urban, Appalachia/non-Appalachia); and trends in HPV-associated cancer incidence rates in Ohio by sex, race, age, and geography (rural/partially rural/urban). Incidence rates are shown for all HPV-associated cancers combined and for each of the six cancer sites/types, with the exception of rates based on case counts less than five. Maps of Ohio county incidence rates are shown for cancer sites/types for which there were fewer than 10 counties with rates based on case counts less than five. All cancers described in this report are invasive, meaning that the tumor is malignant and has infiltrated the organ in which it originated.

For each of the six cancer sites/types associated with HPV, only a certain percentage are actually attributed to HPV. An HPV-attributed cancer is one that is *probably* caused by HPV. Table 1 shows that nearly all (91%) of cervical and anal cancers are attributable to HPV. Each year in the United States, there are an estimated 37,300 new HPV-attributed cancers, about 21,700 in women and 15,600 in men.

Table 1. HPV-Associated Cancers and the Percentage Attributed to HPV

	% Attributed to HPV
Cervical carcinoma	91%
Anal squamous cell carcinoma*	91%
Vaginal squamous cell carcinoma	75%
Oropharyngeal squamous cell carcinoma	70%
Vulvar squamous cell carcinoma	69%
Penile squamous cell carcinoma	63%

Source: Centers for Disease Control and Prevention, 2023: [How Many Cancers Are Linked with HPV Each Year? | CDC](#).

*HPV-associated anal squamous cell carcinomas include rectal cancers.

Key Findings

- In 2021, 69% of Ohio females and 56% of Ohio males 13-17 years old were up-to-date with the HPV vaccine; the Healthy People 2030 target is 80% for both females and males.
- In Ohio, in 2016-2020, an average of 1,958 HPV-associated cancer cases were diagnosed each year.
- The incidence rate of all HPV-associated cancers combined in Ohio (13.9 per 100,000 population) was 11% higher than that for the United States (12.5 per 100,000 population). Ohio incidence rates for all HPV-associated cancers combined were higher than those in the United States for both males (12.4 versus 11.2 per 100,000 population) and females (15.4 versus 13.8 per 100,000 population).
- For all HPV-associated cancers combined, incidence rates were 24% higher among females, compared with males, and 30% higher among White Ohioans, compared with Black Ohioans.
- The incidence rate of all HPV-associated cancers combined increased 63% among males and 8% among females from 1996 to 2020.
- Among males, incidence rates increased considerably from 1996 to 2020 for HPV-associated cancers of the anus and oropharynx.
- Among females, incidence rates increased considerably from 1996 to 2020 for HPV-associated cancers of the anus and vulva.
- The majority of counties with the highest HPV-associated cancer incidence rates were located in the Appalachian region of Ohio.

Sources of Data and Additional Information

- **Ohio Cancer Incidence Surveillance System:**
[Ohio Cancer Incidence Surveillance System \(OCISS\) | Ohio Department of Health.](#)
- **National Cancer Institute:** HPV and Cancer.
[HPV and Cancer - NCI.](#)
- **Centers for Disease Control and Prevention:** HPV and Cancer.
<https://www.cdc.gov/cancer/hpv/statistics/cases.htm>.
- **Centers for Disease Control and Prevention:** HPV Vaccination Recommendations.
[HPV Vaccination Recommendations | CDC.](#)

HPV Infection Prevention

Vaccines are the best way to protect males and females against some of the most common types of HPV. The Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices (ACIP) recommends the following:

- HPV vaccine is recommended for routine vaccination at 11 or 12 years old and can be started at 9 years old.
- ACIP also recommends vaccination for everyone through age 26 years old if not adequately vaccinated when younger.
- Vaccination is not recommended for everyone older than 26 years old. Some adults 27 through 45 years old may decide to get the HPV vaccine based on discussions with their clinician if they did not get adequately vaccinated when they were younger. HPV vaccination in this age range provides less benefit for several reasons, including that more people in this age range have already been exposed to HPV.

HPV vaccination prevents new HPV infections but does not treat existing HPV infections or diseases. The HPV vaccine works best when given before any exposure to HPV.

Most sexually active adults have already been exposed to HPV, although not necessarily all of the HPV types targeted by vaccination. At any age, having a new sex partner is a risk factor for getting a new HPV infection. People who are in a long-term, mutually monogamous relationship are not likely to get a new HPV infection. Abstaining from sexual activity is the most reliable method for preventing genital HPV infection. People can decrease their chances of infection by practicing consistent and correct condom use and limiting their number of sex partners. Although these interventions may not fully protect against HPV, they can decrease the chances of HPV acquisition and transmission.

HPV Vaccination Dosing Schedules

Ages 9-14

Two doses of HPV vaccine are recommended for most people starting the series before their 15th birthday.

- The second dose of HPV vaccine should be given six to 12 months after the first dose.
- Those who receive two doses less than five months apart will require a third dose of HPV vaccine.

Ages 15-26 and/or Immunocompromised

- Three doses of HPV vaccine are recommended for teens and young adults who start the series at 15 through 26 years old and for immunocompromised persons 9 through 26 years old.
- The recommended three-dose schedule is zero (initial dose), one to two months after initial dose, and six months after initial dose.
- Three doses are recommended for immunocompromised people (including those with HIV infection) 9 through 26 years old.

People meeting these recommendations are considered up-to-date with HPV vaccinations.

Please refer to the CDC for information concerning HPV vaccine contraindications and precautions, pregnancy, vaccine safety, and adverse reactions: [HPV Vaccination Recommendations | CDC](#).

HPV Vaccination in the United States and Ohio

Figures 1 and 2 show the estimated prevalence of up-to-date HPV vaccination among female and male adolescents (13-17 years old), respectively, in the United States. Compared with the estimated prevalence in other U.S. states, Ohio HPV vaccination coverage among females was higher than that of 38 other states whereas the estimated prevalence among males was higher than only 14 other states. Nearly all states, including Ohio, are below the Healthy People 2030 benchmark of 80% of adolescents receiving the recommended HPV vaccinations.

Figure 1. Percent Up-to-Date HPV Vaccination Coverage Among Females 13-17 Years Old, 2021

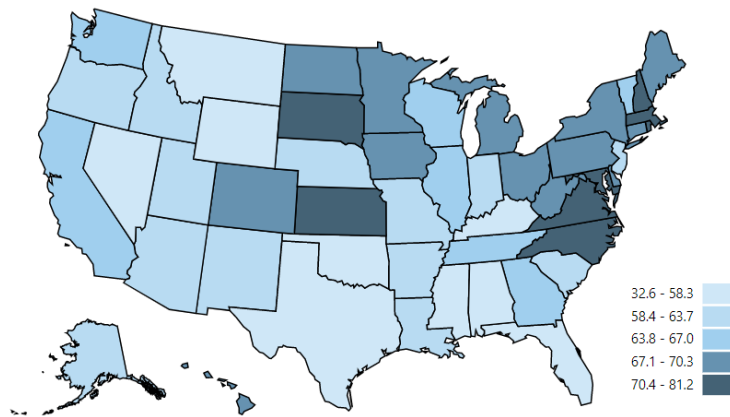
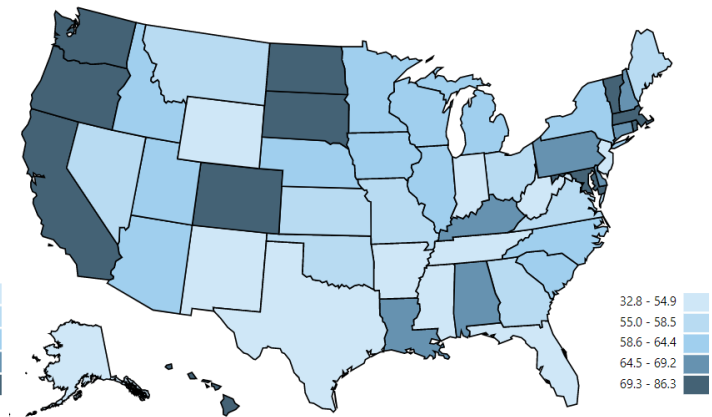


Figure 2. Percent Up-to-Date HPV Vaccination Coverage Among Males 13-17 Years Old, 2021



Source: National Center for Immunization and Respiratory Diseases, 2023.
<https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/index.html>.

Table 2 shows the estimated 2021 vaccination rates among 13-17 year olds in Ohio and the United States. Despite the demonstrated effectiveness of the HPV vaccines, rates remain well below Healthy People 2030 goals (80% recommended vaccination rate for both females and males).

- 82% of Ohio females 13-17 years old had initiated the HPV vaccine, and 69% of Ohio females were up-to-date with HPV vaccination.
- 63% of Ohio males 13-17 years old had initiated the HPV vaccine, and 56% of Ohio males were up-to-date with HPV vaccination.

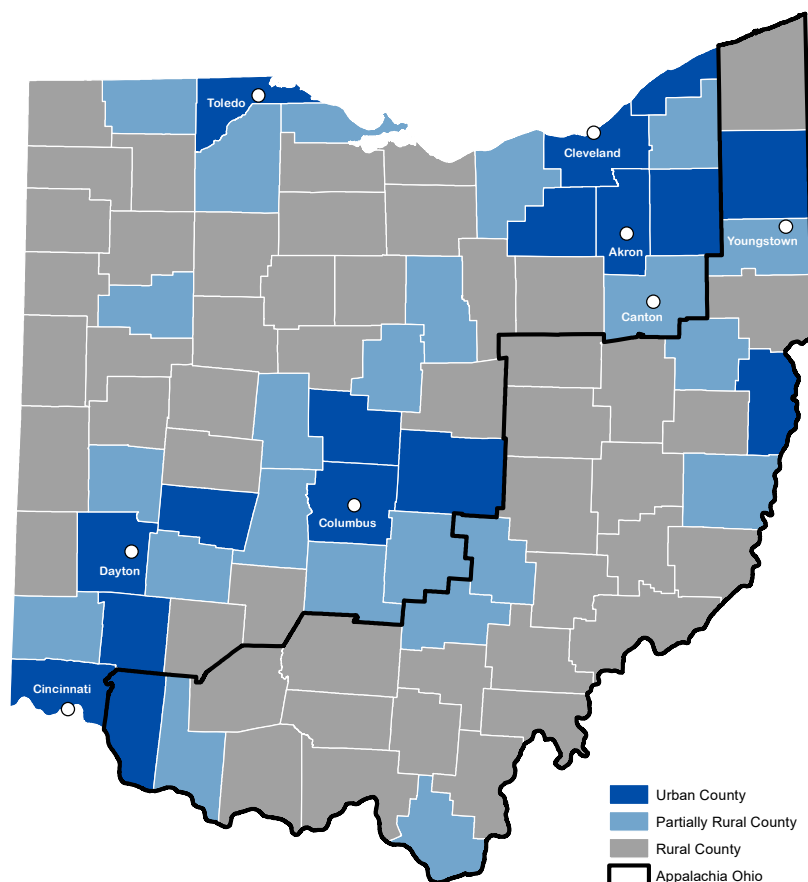
Table 2. Estimated HPV Vaccination Coverage Among Adolescents 13-17 Years Old in Ohio and the United States, 2021

	≥ 1 Dose of HPV Vaccine		Up-to-date	
	Ohio	US	Ohio	US
Females	82%	79%	69%	64%
Males	63%	75%	56%	60%

Source: National Center for Immunization and Respiratory Diseases, 2023.
<https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/index.html>.

Ohio Geography

Figure 3. Urban, Partially Rural, and Rural Counties and the 32-County Appalachian Region of Ohio



Source: Ohio Cancer Incidence Surveillance System and Primary Care Office, Ohio Department of Health, 2023.

Public health reports and results presented in research articles have revealed that cervical and oropharyngeal cancer incidence and mortality rates are, in general, higher in Appalachia Ohio, a 32-county region along the southern and eastern borders of Ohio. These disparities have largely been attributed to differences in factors related to HPV. The Appalachian region of Ohio is highlighted in Figure 3. In addition, trends in HPV-associated incidence rates were examined in groupings of non-contiguous rural, partially rural, and urban counties of Ohio, also shown in Figure 3.

HPV vaccination prevents cancer.

37,300

**cases of cancer could be prevented by HPV
vaccination each year in the United States.**

HPV-Associated Cancers: Incidence by Sex, Race, Ethnicity, Age Group, and Geography

Table 3. HPV-Associated Cancers: Average Annual Number of Cancer Cases and Age-Adjusted Incidence Rates per 100,000 Population by Sex, Race, Ethnicity, Age Group, and Geography in Ohio, 2016-2020

	All HPV-Associated Sites/Types		Cervix		Anus		Vagina		Oropharynx		Vulva		Penis	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Ohio Total	1,958	13.9	457	*	313	2.1	35	*	887	5.8	209	*	56	*
Sex														
Males	886	12.4	*	*	93	1.4	*	*	737	10.1	*	*	56	0.9
Females	1,071	15.4	457	7.5	220	2.8	35	0.4	150	1.9	209	2.7	*	*
Race														
White	1,751	14.3	385	7.6	277	2.2	29	0.4	818	6.1	192	2.9	51	0.9
Black	175	11.0	57	7.2	32	2.0	5	0.6	61	3.7	15	1.8	4	0.7
Asian or Pacific Islander	11	3.8	5	3.4	2	0.7	0	0.0	2	0.9	1	0.8	<1	**
Ethnicity														
Non-Hispanic	1,929	14.0	443	7.5	310	2.2	35	0.4	880	5.9	207	2.8	54	0.8
Hispanic	28	9.0	14	8.2	3	1.1	0	**	7	2.2	2	1.5	2	1.5
Age Group														
0-49	390	5.7	223	6.5	43	0.6	3	0.1	83	1.2	32	1.0	5	0.2
50-69	1,104	35.6	182	11.9	185	6.0	16	1.0	612	19.4	89	5.5	23	1.5
70+	463	34.7	53	7.0	86	6.4	17	2.1	191	14.4	88	11.2	28	5.1
Geography														
Appalachia	397	15.7	90	8.7	58	2.3	6	0.4	183	6.5	46	3.4	13	1.1
Non-Appalachia	1,560	13.5	367	7.3	255	2.1	29	0.4	704	5.6	164	2.6	43	0.8
Rural	431	15.1	97	8.4	67	2.3	6	0.4	192	6.1	53	3.4	17	1.2
Partially Rural	474	14.1	110	7.8	75	2.1	9	0.5	211	5.7	57	3.2	13	0.8
Urban	1,052	13.3	251	7.1	171	2.1	20	0.4	484	5.7	100	2.3	26	0.7

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

* Not Applicable; sex-specific cancer.

** Rates not presented when case counts for 2016-2020 is less than five.

Table 3 shows the average annual number of cancer cases and age-adjusted incidence rates of HPV-associated cancers by sex, race, ethnicity, age group, and geographic regions in Ohio.

- In 2016-2020, there was an annual average of 1,958 cases of all HPV-associated cancers combined in Ohio. Oropharyngeal cancer had the highest number of cases of the HPV-associated cancers, with an annual average of 887 cases in Ohio. Cervical cancer was the second most common (457 cases).
- The incidence rate of all HPV-associated cancers combined was 24% higher among females than males, and the rate of HPV-associated anal cancers among females was double that of males. The HPV-associated oropharyngeal cancer incidence rate was more than five times higher in males, compared with females.
- The incidence rate of all HPV-associated cancers combined was 30% higher among White Ohioans, compared with Black Ohioans, and nearly four times that of Asian/Pacific Islander Ohioans. Incidence rates were considerably higher among White Ohioans for HPV-associated oropharyngeal and vulvar cancers, compared with Black Ohioans, while incidence rates were considerably lower for each HPV-associated cancer site among Asian/Pacific Islander Ohioans.
- The incidence rate of all HPV-associated cancers combined was 56% higher among non-Hispanic Ohioans than Hispanic Ohioans. Incidence rates were considerably higher among non-Hispanic Ohioans for HPV-associated anal, oropharyngeal, and vulvar cancers, while the incidence rates of HPV-associated cervical and penile cancers were higher among Hispanic Ohioans.
- For HPV-associated anal, vaginal, vulvar, and penile cancers, incidence rates increased with advancing age group, while incidence rates for HPV-associated cervical and oropharyngeal cancers were highest in the 50 to 69 years age group.
- The incidence rate of all HPV-associated cancers combined was 16% higher in the Appalachian region of Ohio, compared with the non-Appalachian region. With the exception of HPV-associated vaginal cancer, incidence rates were higher for each HPV-associated cancer site in the Appalachian region of Ohio, compared with the non-Appalachian region.
- The incidence rate of all HPV-associated cancers combined was 14% higher in rural counties of Ohio, compared with urban counties, and 7% higher compared with partially rural counties. Incidence rates were highest in rural counties (compared with both partially rural and urban counties) for HPV-associated cervical, anal, oropharyngeal, vulvar, and penile cancers.

The following points pertain to comparisons between Ohio and the United States (not shown in Table 3).

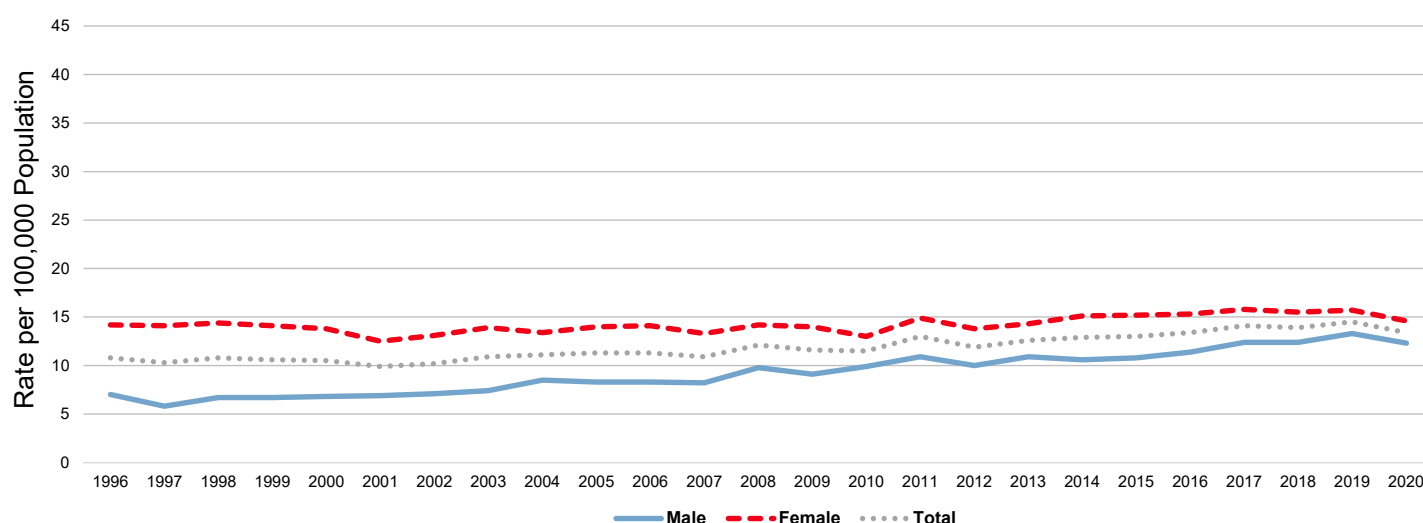
- The incidence rate of all HPV-associated cancers combined in Ohio (13.9 per 100,000 population) was 11% higher than that for the United States (12.5 per 100,000 population). Ohio incidence rates for all HPV-associated cancers combined were higher than those in the United States for both males (12.4 versus 11.2 per 100,000 population) and females (15.4 versus 13.8 per 100,000 population).
- Incidence rates for HPV-associated cancers among males in Ohio were similar to those for the United States, with the exception that the incidence rate for HPV-associated oropharyngeal cancer was 11% greater in Ohio (10.1 per 100,000 population), compared with the United States (9.1 per 100,000 population).
- Among females, incidence rates were slightly higher in Ohio for HPV-associated cervical, anal, oropharyngeal, and vulvar cancers (7.5, 2.8, 1.9, and 2.7 per 100,000 population, respectively), compared with those for the United States (7.2, 2.5, 1.7, and 2.1 per 100,000 population, respectively).
- In general, race differences in incidence rates of HPV-associated cancers were similar in Ohio and the United States.

All HPV-Associated Cancers Combined: Incidence Trends

Trends in incidence rates of all HPV-associated cancers combined are shown in Figures 4-7.

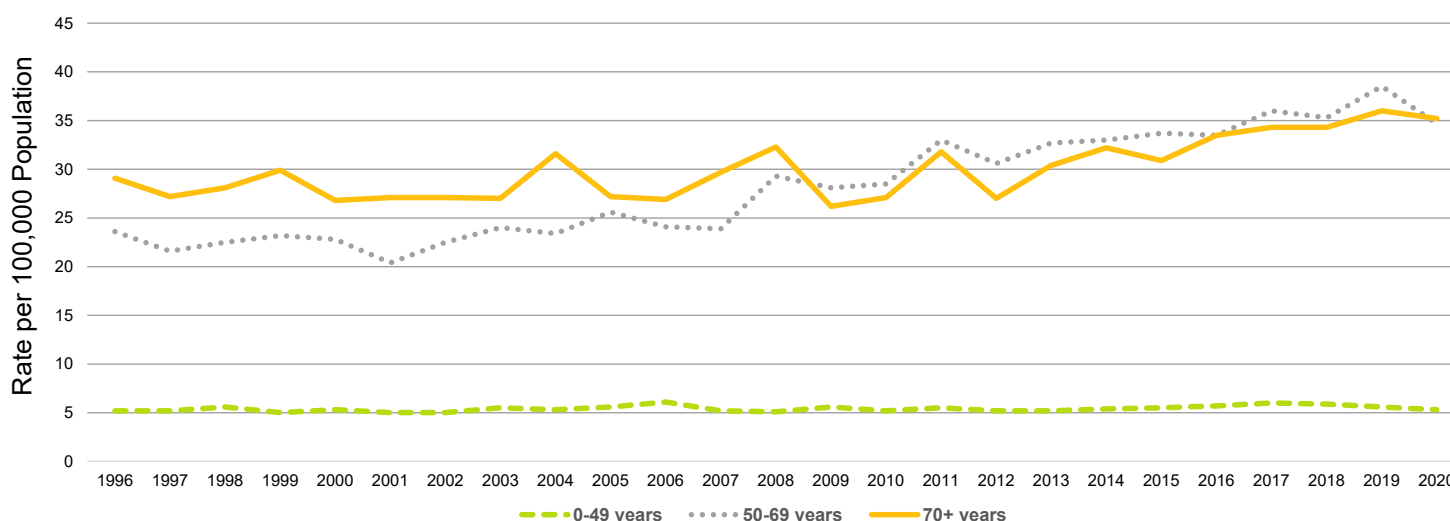
- HPV-associated cancer incidence rates increased 63% among males and 8% among females in Ohio from 1996 to 2020. The incidence rate was higher among females for each year.
- Incidence rates were slightly variable from 1996 to 2007 for Ohioans 50-69 years old and 70 years old and older, but then increased through 2020 for both age groups.

Figure 4. All HPV-Associated Cancers Combined: Trends in Age-Adjusted Incidence Rates per 100,000 Population and by Sex and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

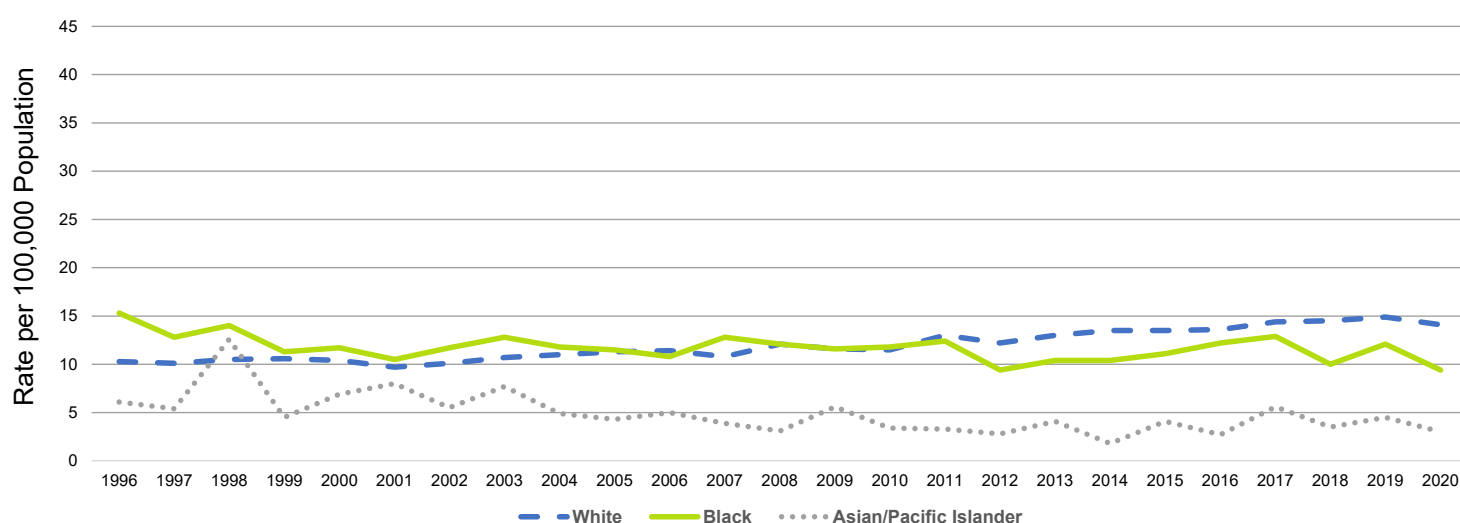
Figure 5. All HPV-Associated Cancers Combined: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Age Group and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

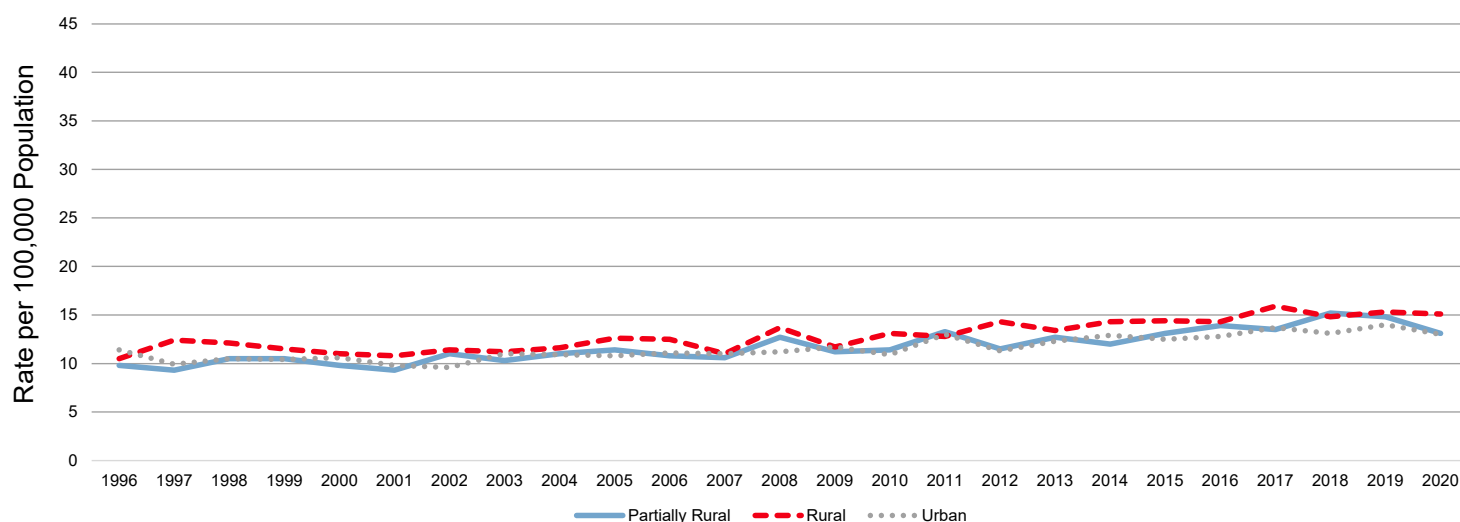
- HPV-associated cancer incidence rates increased among White Ohioans from 1996 to 2020 and decreased among Black and Asian/Pacific Islander Ohioans. In earlier years (1996-2003), incidence rates were slightly higher among Black Ohioans, and in later years (2012-2020), incidence rates were slightly higher among White Ohioans.
- HPV-associated cancer incidence rates increased similarly from 1996 to 2020 in urban, rural, and partially rural counties of Ohio.

Figure 6. All HPV-Associated Cancers Combined: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Race and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 7. All HPV-Associated Cancers Combined: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Rurality and Year of Diagnosis in Ohio, 1996-2020

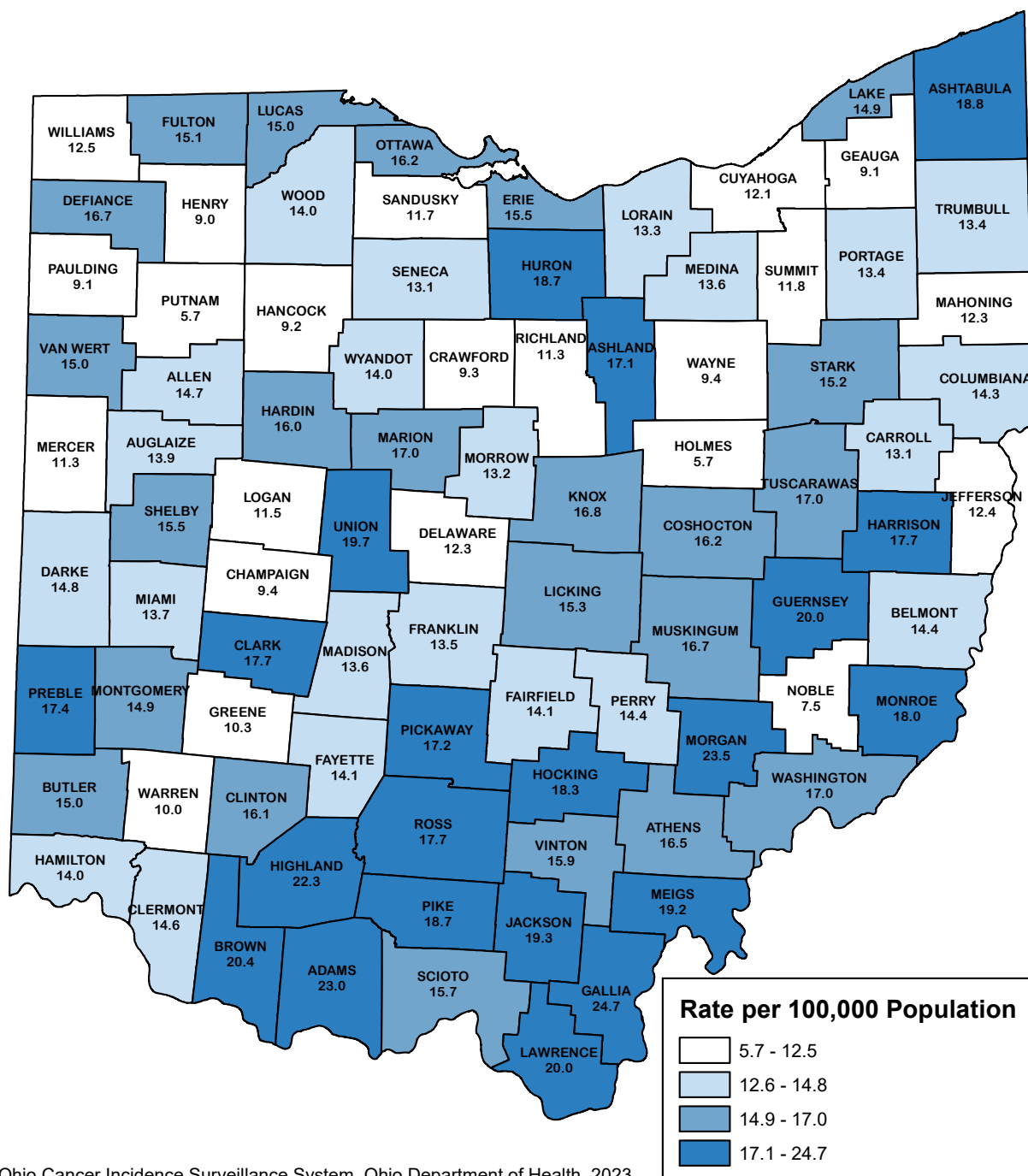


Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

All HPV-Associated Cancers Combined: Incidence by County

Figure 8 shows 2016-2020 average annual, age-adjusted incidence rates for all HPV-associated cancers combined by county of residence. County-specific incidence rates in Ohio ranged from 5.7 to 24.7 per 100,000 population. The majority of counties with the highest incidence rates were located in the southeastern region of Ohio.

Figure 8. All HPV-Associated Cancers Combined: Average Annual Age-Adjusted Incidence Rates per 100,000 Population by County of Residence in Ohio, 2016-2020



Figures 9 and 10 show 2016-2020 average annual, age-adjusted incidence rates for all HPV-associated cancers combined for females (Figure 9) and males (Figure 10) by county of residence. For both females and males, the majority of counties with the highest incidence rates were located in southern Ohio.

Figure 9. All HPV-Associated Cancers Combined: Average Annual Age-Adjusted Incidence Rates per 100,000 Females by County of Residence in Ohio, 2016-2020

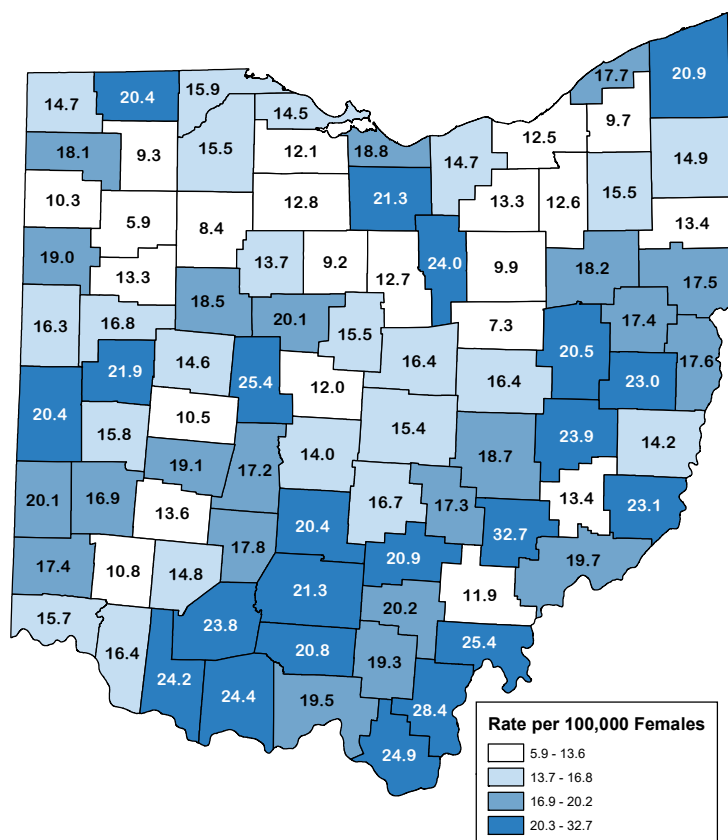
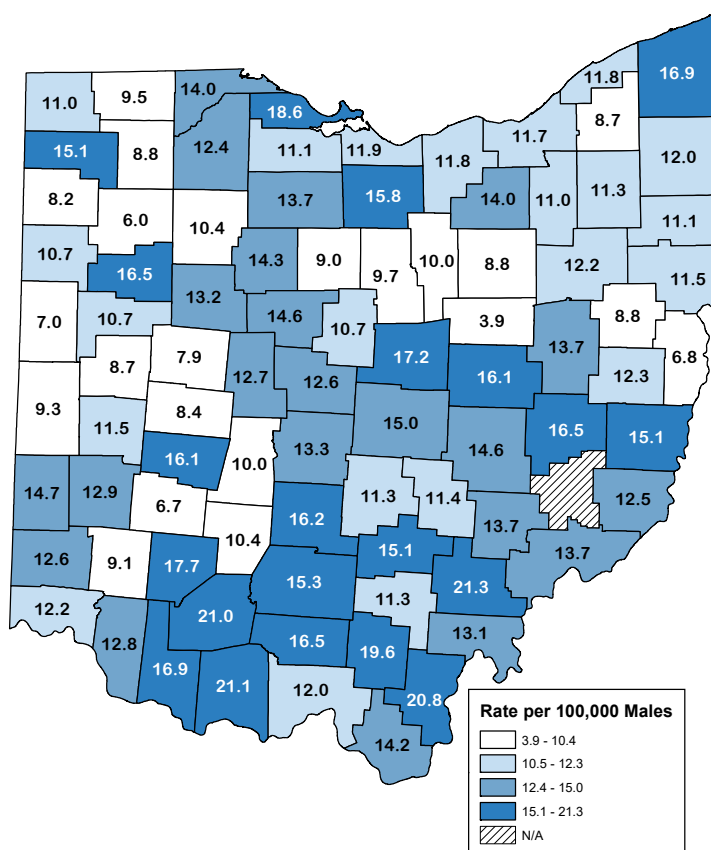


Figure 10. All HPV-Associated Cancers Combined: Average Annual Age-Adjusted Incidence Rates per 100,000 Males by County of Residence in Ohio, 2016-2020



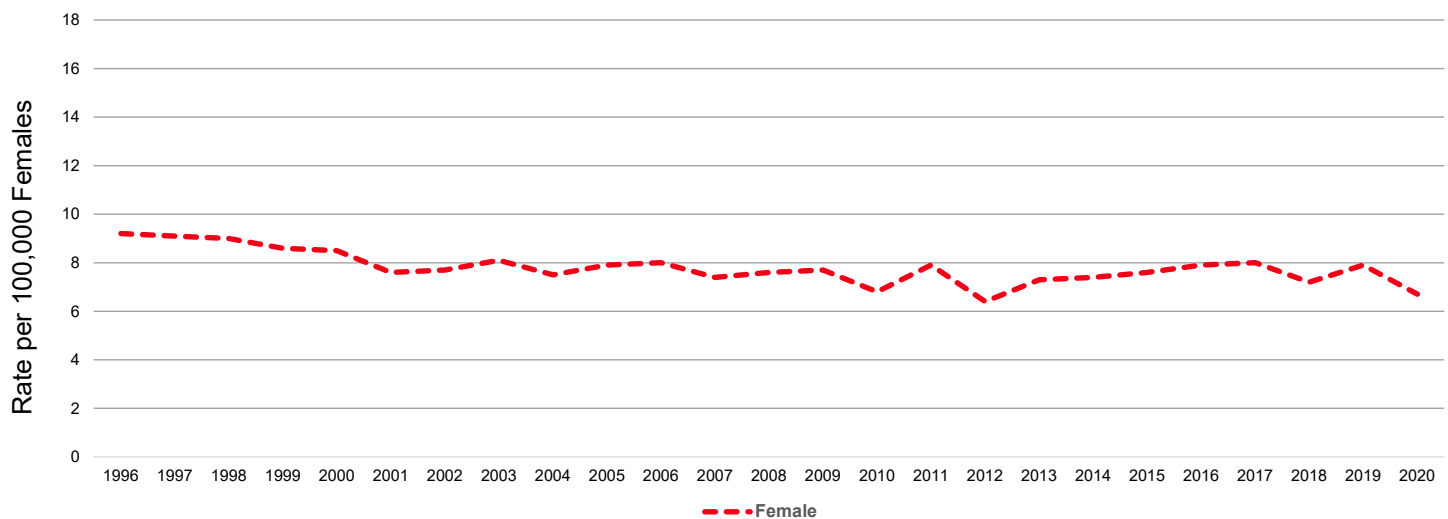
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.
Each category represents approximately 25% of the 88 Ohio counties.
N/A: Rate not calculated when the case count for 2016-2020 is less than five.

HPV-Associated Cervical Cancer: Incidence Trends

Trends in incidence rates of HPV-associated cervical cancer from 1996 to 2020 are shown in Figures 11-14.

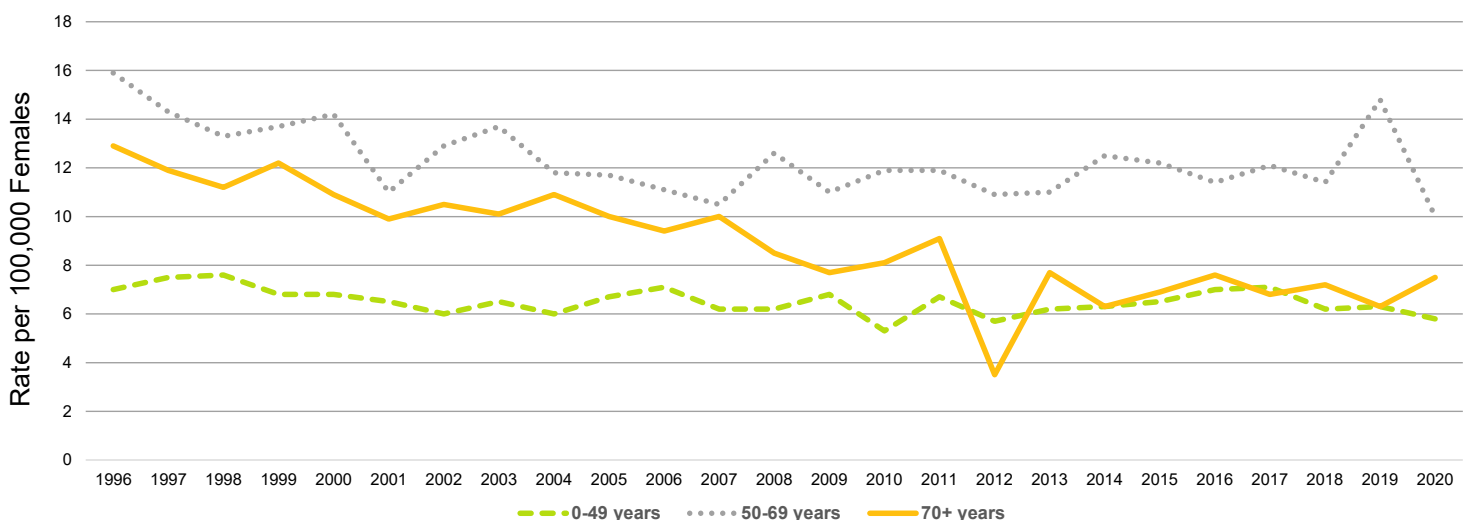
- The incidence rate of HPV-associated cervical cancer decreased 14% in Ohio from 1996 to 2020.
- HPV-associated cervical cancer incidence rates remained relatively stable for women 0-49 years old from 1996 to 2020, while the rate decreased considerably among women 50-69 years old and women 70 years old and older. For each year, the rate was highest among women 50-69 years old.

Figure 11. HPV-Associated Cervical Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

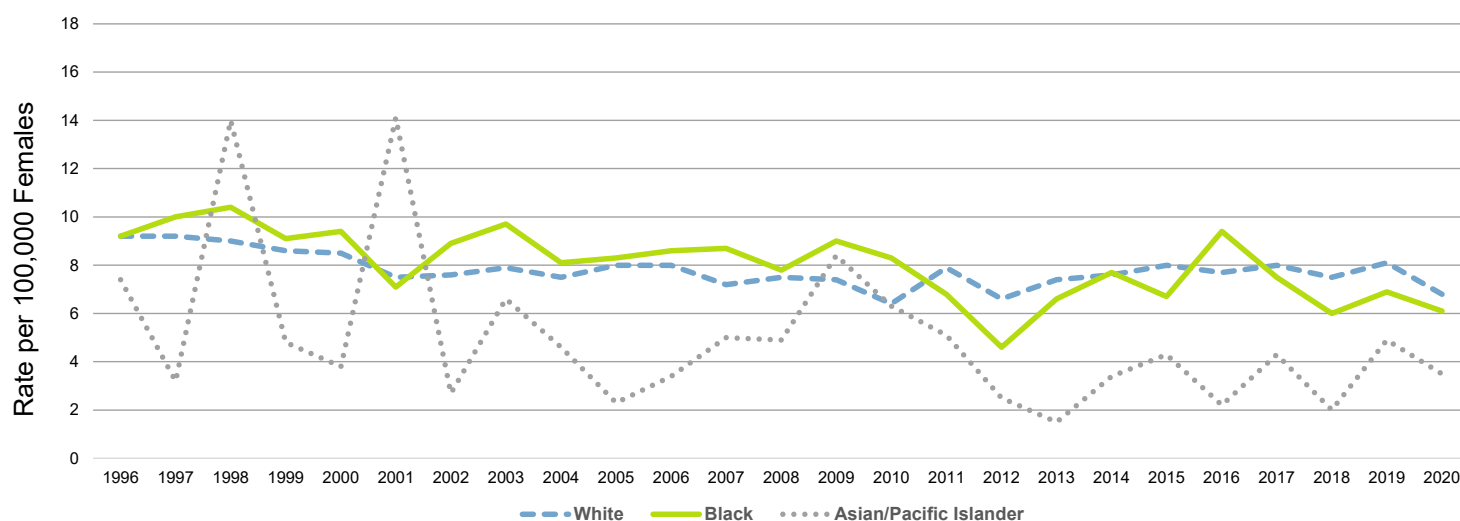
Figure 12. HPV-Associated Cervical Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Age Group and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

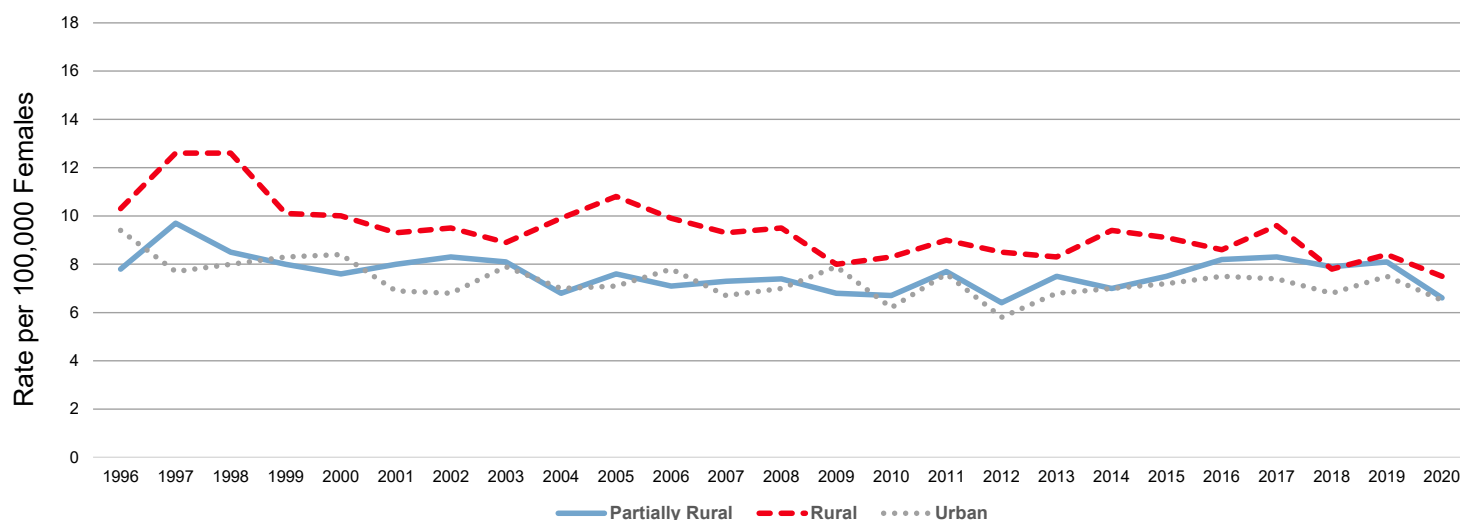
- HPV-associated cervical cancer incidence rates slightly decreased from 1996 to 2020 for White and Black women in Ohio, while the incidence rate among Asian/Pacific Islander women was sporadic.
- HPV-associated cervical cancer incidence rates decreased in urban, rural, and partially rural counties of Ohio from 1996 to 2020, and the percent decrease was greatest for women in rural counties.

Figure 13. HPV-Associated Cervical Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Race and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 14. HPV-Associated Cervical Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Rurality and Year of Diagnosis in Ohio, 1996-2020

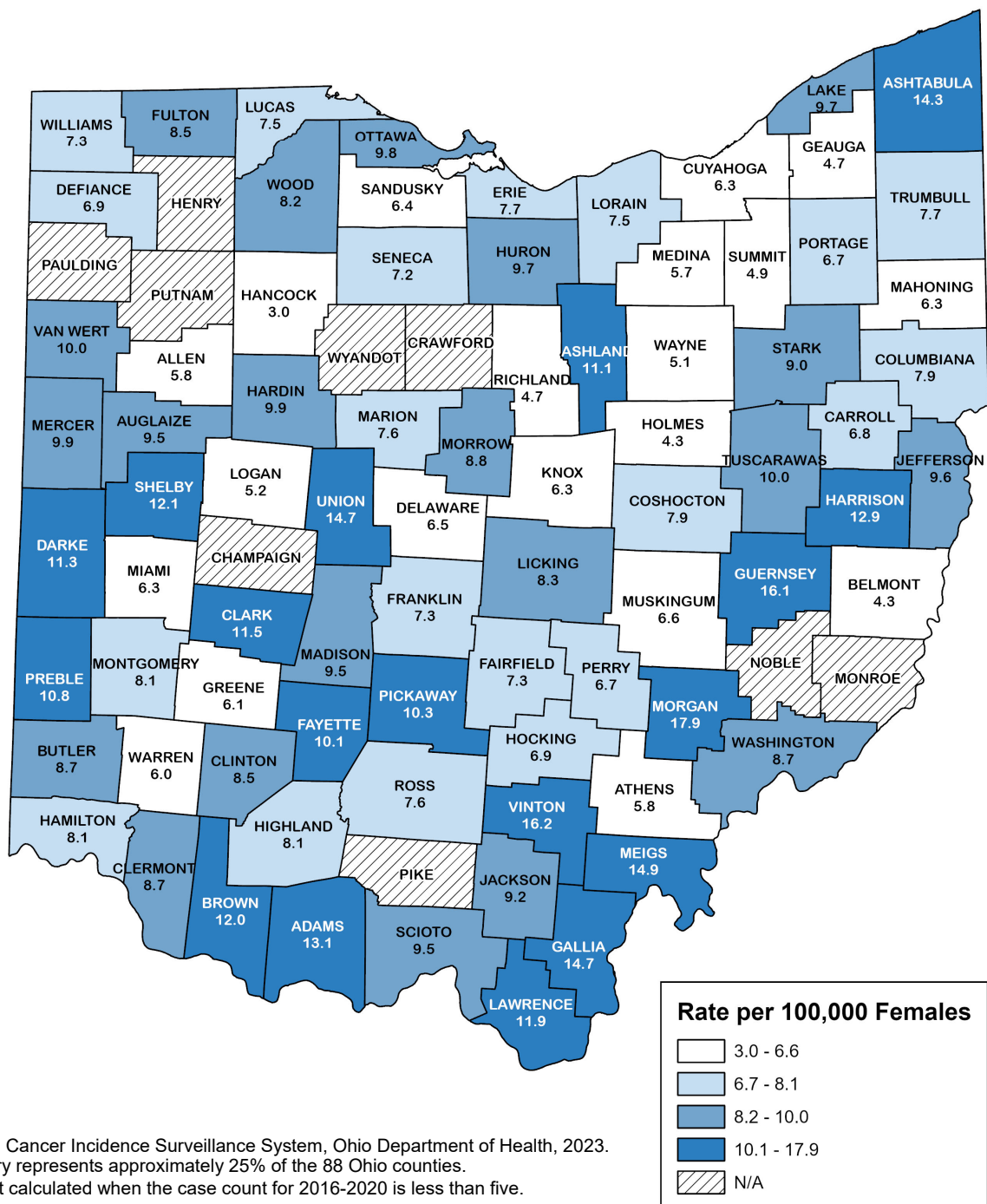


Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

HPV-Associated Cervical Cancer: Incidence by County

Figure 15 shows 2016-2020 average annual, age-adjusted incidence rates for HPV-associated cervical cancer by county of residence. County-specific incidence rates in Ohio ranged from 3.0 to 17.9 per 100,000 females. The majority of counties with the highest incidence rates were located in rural counties of Ohio.

Figure 15. HPV-Associated Cervical Cancer: Average Annual Age-Adjusted Incidence Rates per 100,000 Females by County of Residence in Ohio, 2016-2020



2021-2030 Ohio Comprehensive Cancer Control Plan



The [2021–2030 Ohio Comprehensive Cancer Control Plan](#) (Cancer Plan) is a strategic plan aimed at reducing the cancer burden in the state. The development of the Cancer Plan was led by the Ohio Partners for Cancer Control (OPCC), Ohio’s cancer coalition. The Cancer Plan was developed with input from more than 150 individuals representing more than 50 organizations. Seventeen topical workgroups worked effectively to propose objectives and strategies for the plan. The plan includes 49 objectives organized into three goal areas: primary prevention, early detection, and quality of life for persons affected by cancer. Beginning in 2021, the topical workgroups established to develop objectives and strategies shifted their focus to implementing the Cancer Plan’s strategies.

The Vaccines for Cancer Prevention/HPV-Associated Cancers topical workgroup is focused on implementing strategies to decrease the HPV-associated cancer incidence rate, as well as increase the percentage of adolescents and young adults who are up-to-date with HPV vaccination. The workgroup consists of a diverse group of stakeholders including public health professionals, non-profit organizations, healthcare providers and systems, universities and researchers, cancer survivors, cancer advocates, and community organizations.

In 2023, the workgroup is actively working on implementing the following Cancer Plan strategies:

- Educate health and dental providers about current Advisory Committee on Immunization Practices (ACIP) recommendations regarding HPV vaccination to improve health and dental professional knowledge, practice behaviors, and system support.
- Promote statewide public awareness campaigns that encourage HPV vaccination and cancer prevention.

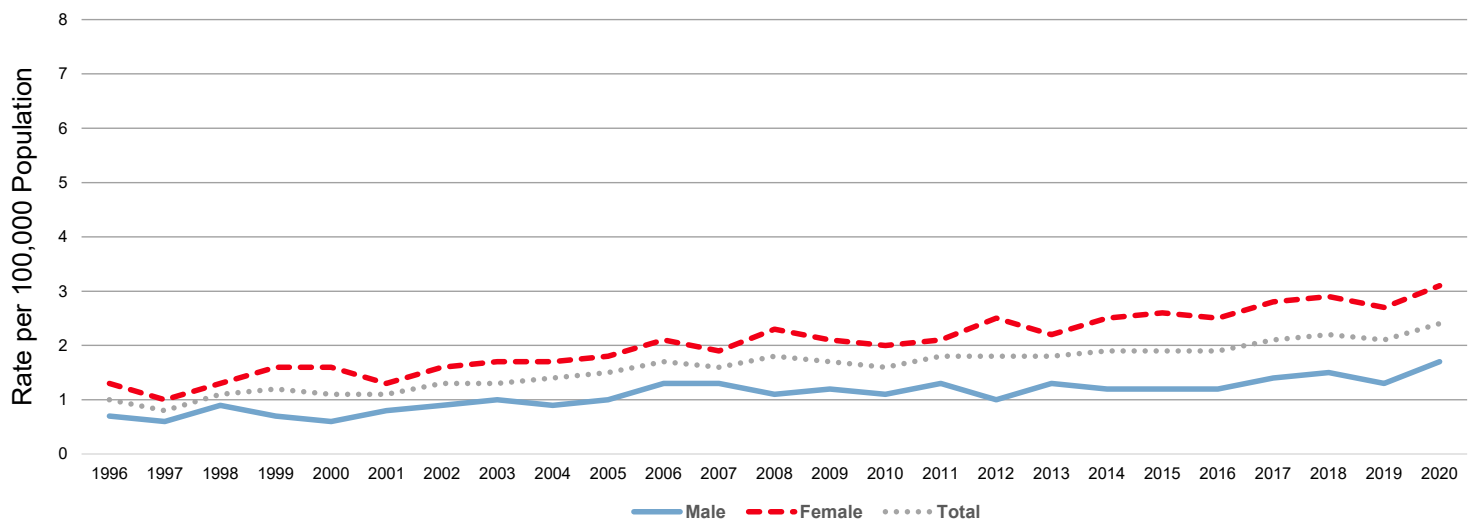
For more information about this workgroup, please contact [OPCC](#) at opcc@odh.ohio.gov.

HPV-Associated Anal Cancer: Incidence Trends

Trends in incidence rates of HPV-associated anal cancer from 1996 to 2020 are shown in Figures 16-19.

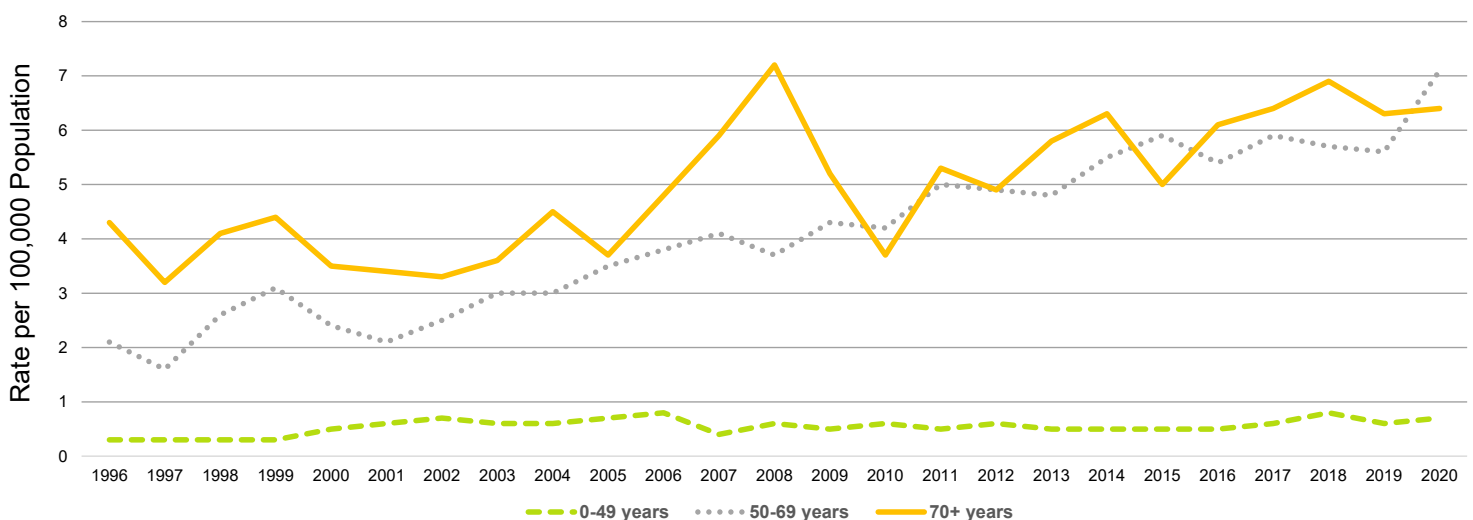
- HPV-associated anal cancer incidence rates more than doubled among both males and females from 1996 to 2020. For each year, the HPV-associated anal cancer incidence rate was slightly higher among females.
- The HPV-associated anal cancer incidence rate remained relatively stable for those 0-49 years old from 1996 to 2020, while the rate increased more than three-fold for those 50-69 years old and 51% for those 70 years old and older. From 2009 to 2020, the rate was similar among those 50-69 years old and those 70 years old and older.

Figure 16. HPV-Associated Anal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Sex and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

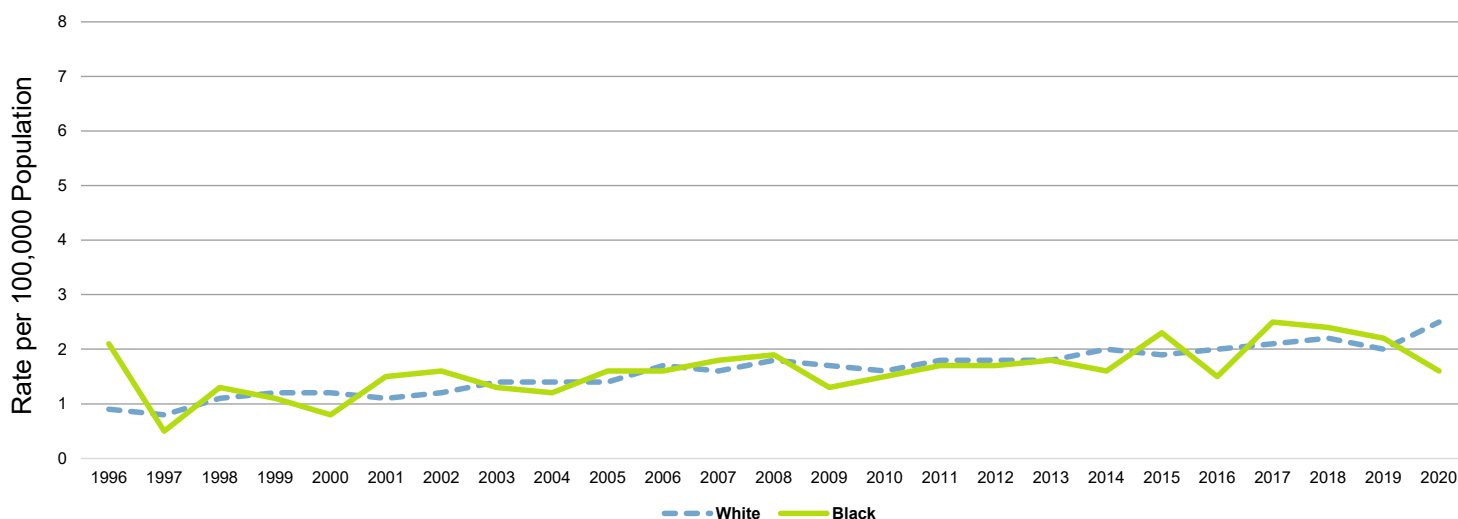
Figure 17. HPV-Associated Anal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Age Group and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

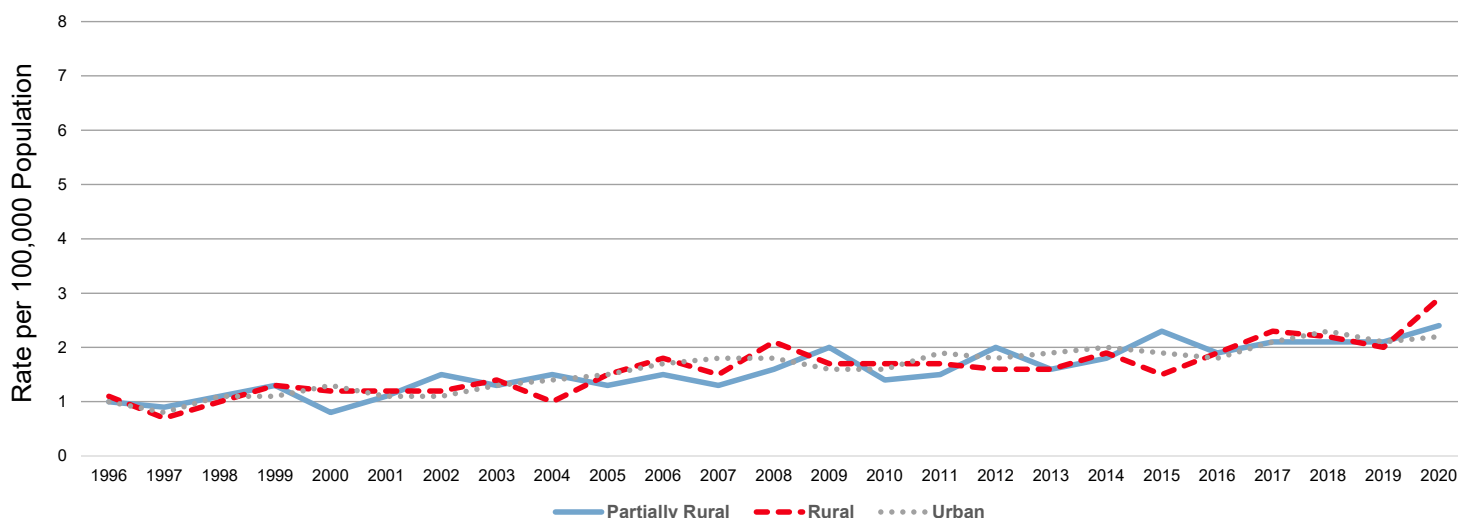
- HPV-associated anal cancer incidence rates increased similarly in White and Black Ohioans from 1996 to 2020.
- HPV-associated anal cancer incidence rates increased similarly in urban, rural, and partially rural counties of Ohio from 1996 to 2020.

Figure 18. HPV-Associated Anal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Race and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 19. HPV-Associated Anal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Rurality and Year of Diagnosis in Ohio, 1996-2020



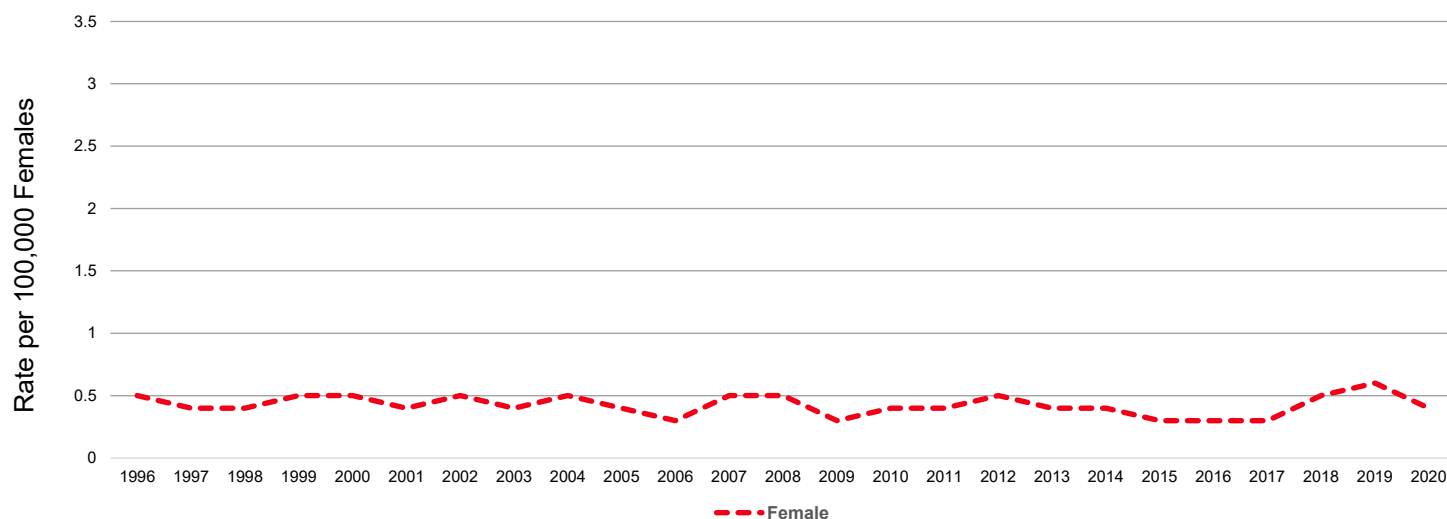
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

HPV-Associated Vaginal Cancer: Incidence Trends

Trends in incidence rates of vaginal cancer from 1996 to 2020 are shown in Figures 20-23.

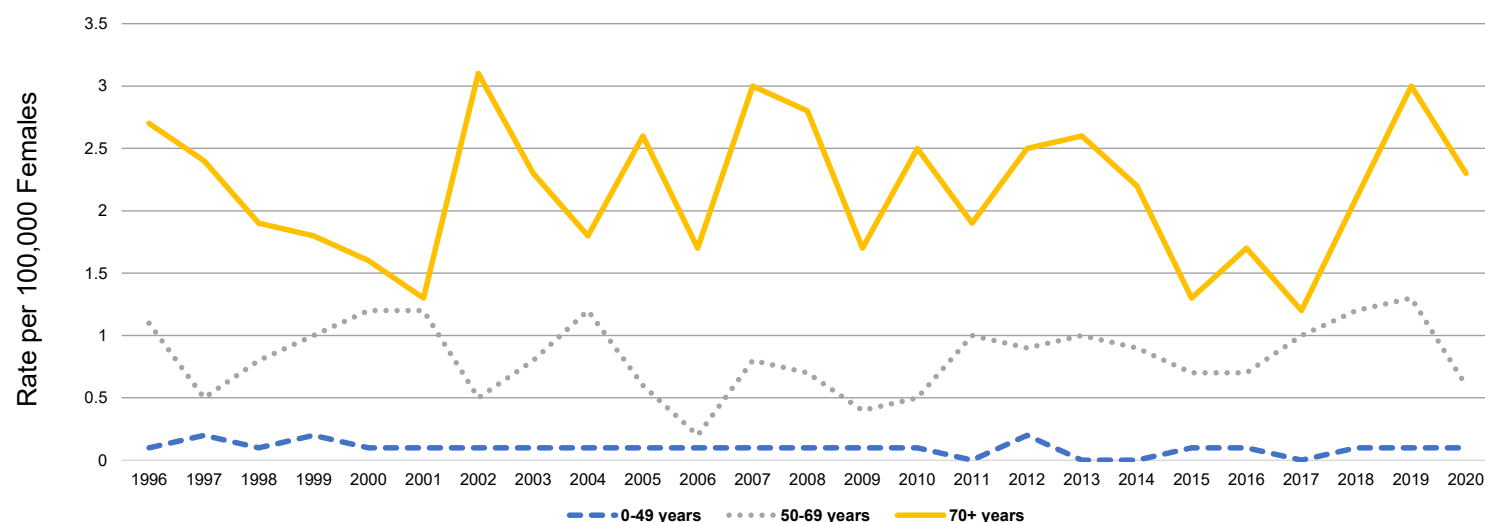
- HPV-associated vaginal cancer incidence rates were relatively stable from 1996 to 2020.
- The HPV-associated vaginal cancer incidence rate remained stable for those 0-49 years old from 1996 to 2020, while the rate was sporadic for those 50-69 years old and those 70 years old and older. For each year, the rate was highest among those 70 years old and older.

Figure 20. HPV-Associated Vaginal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

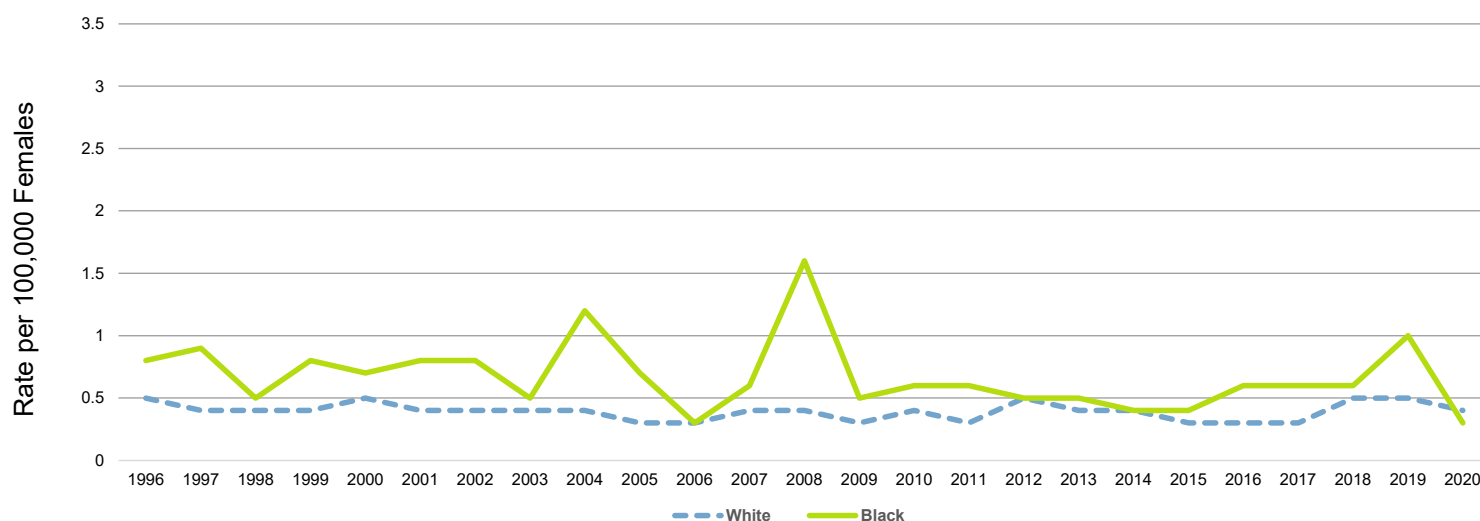
Figure 21. HPV-Associated Vaginal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Age Group and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

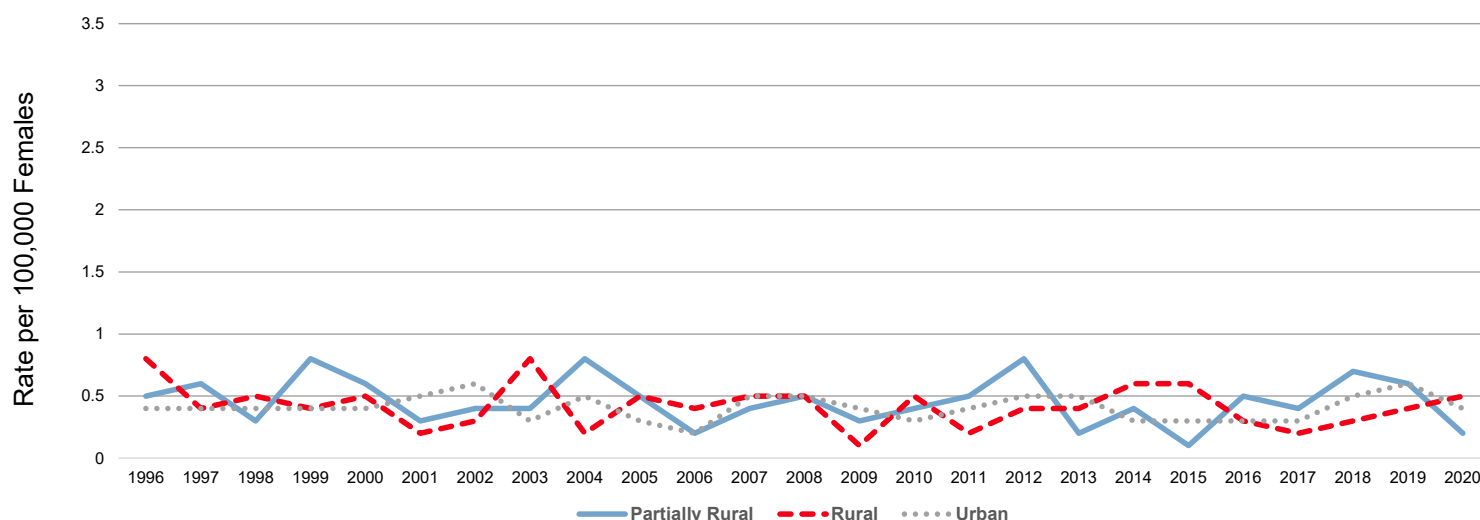
- HPV-associated vaginal cancer incidence rates were relatively stable among both White and Black Ohio women from 1996 to 2020. For most years, the rate was higher among Black women in Ohio.
- HPV-associated vaginal cancer incidence rates were similar in urban, rural, and partially rural counties of Ohio from 1996 to 2020.

Figure 22. HPV-Associated Vaginal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Race and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 23. HPV-Associated Vaginal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Rurality and Year of Diagnosis in Ohio, 1996-2020



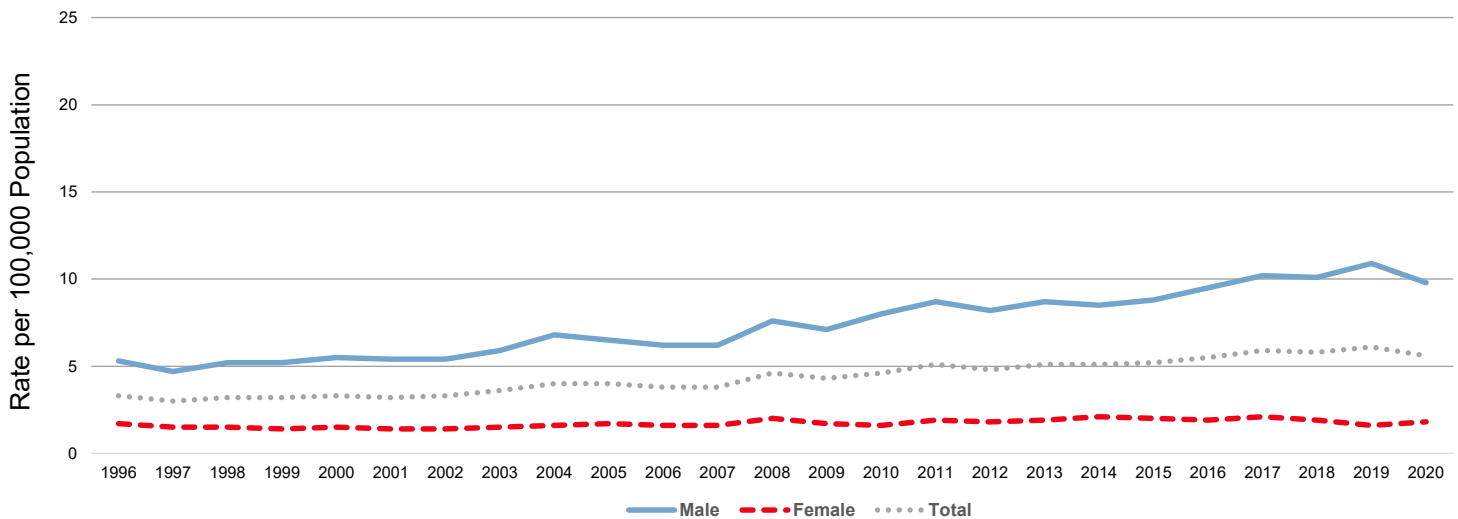
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

HPV-Associated Oropharyngeal Cancer: Incidence Trends

Trends in incidence rates of HPV-associated oropharyngeal cancer are shown in Figures 24-27.

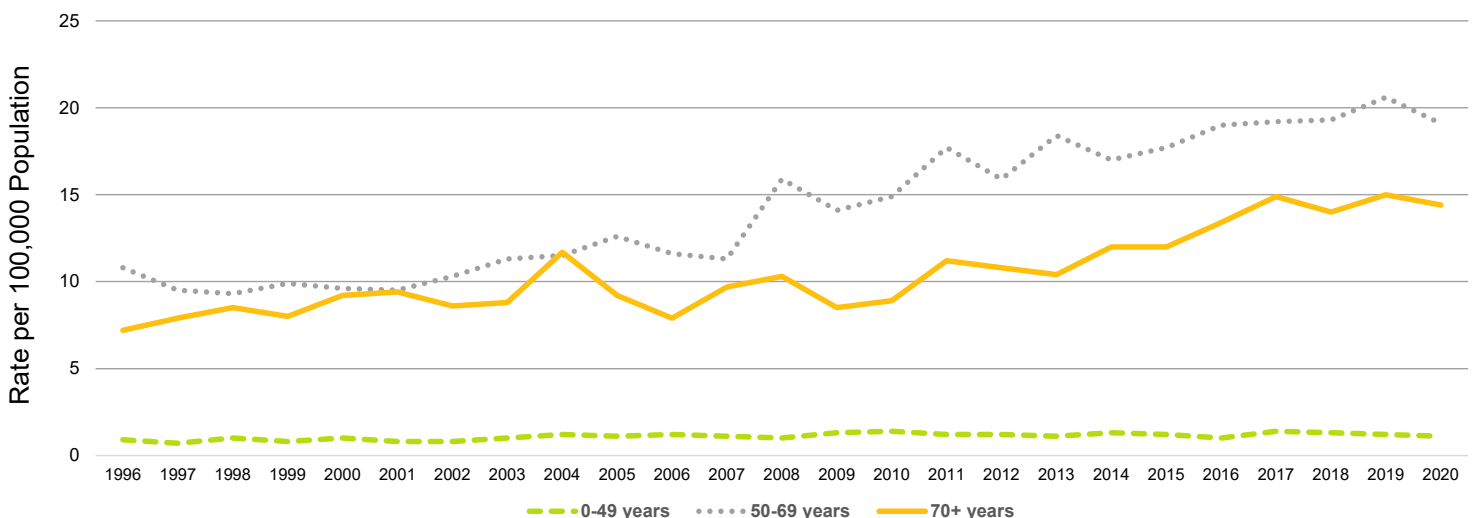
- HPV-associated oropharyngeal cancer incidence rates were much higher among males, compared with females. Among males, the rate approximately doubled from 1996 to 2020, while the incidence rate among females remained stable.
- HPV-associated oropharyngeal cancer incidence rates remained relatively stable for those 0-49 years old from 1996 to 2020, while rates decreased considerably for those 50-69 years old and those 70 years old and older. From 2005 to 2020, for most years, the rate was highest among those 50-69 years old.

Figure 24. HPV-Associated Oropharyngeal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Sex and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

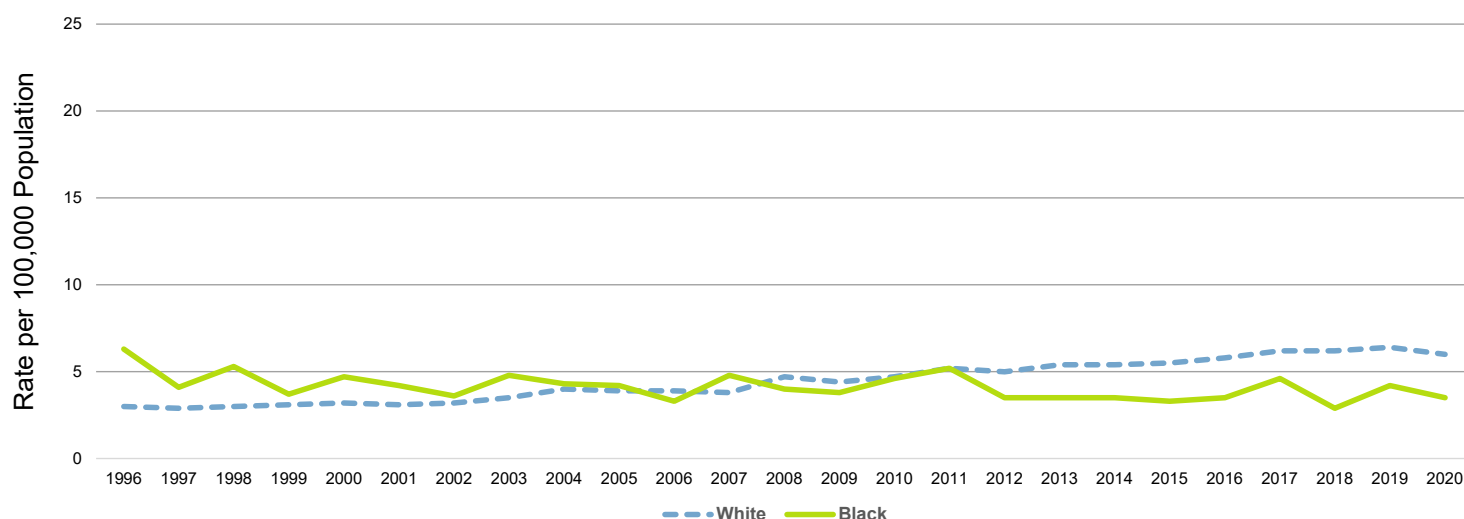
Figure 25. HPV-Associated Oropharyngeal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Age Group and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

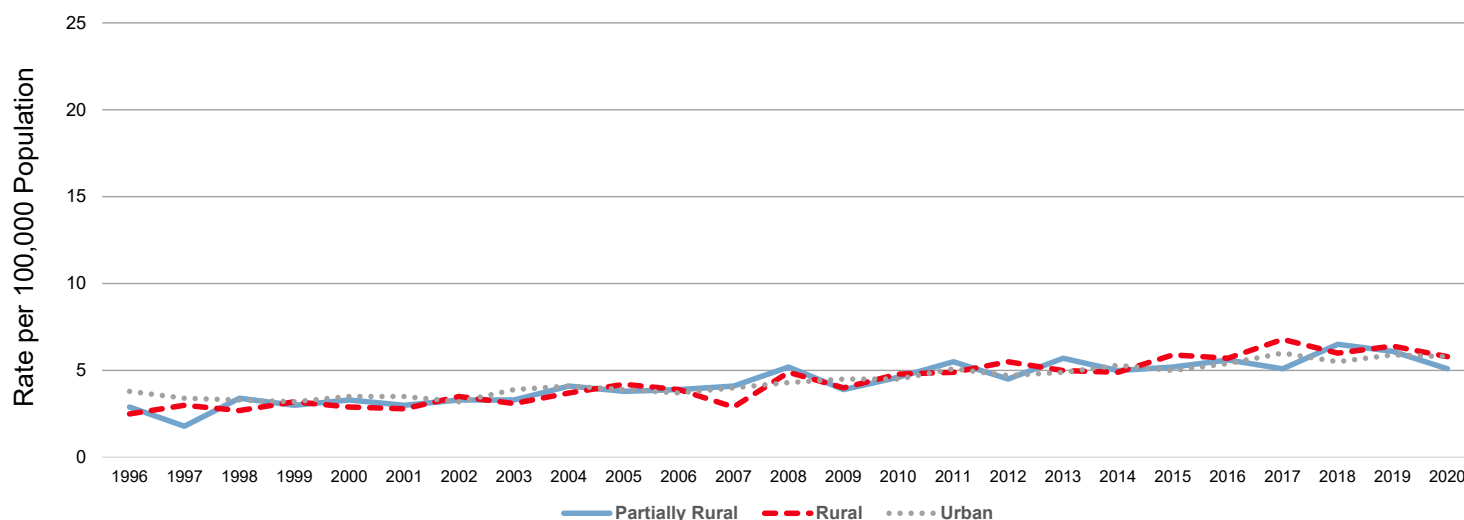
- The HPV-associated oropharyngeal cancer incidence rate approximately doubled from 1996 to 2020 among White Ohioans and decreased among Black Ohioans (although the rate among Black Ohioans was more sporadic during the period, likely due to small case counts).
- HPV-associated oropharyngeal cancer incidence rates increased similarly in urban, rural, and partially rural counties of Ohio from 1996 to 2020.

Figure 26. HPV-Associated Oropharyngeal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Race and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 27. HPV-Associated Oropharyngeal Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Population by Rurality and Year of Diagnosis in Ohio, 1996-2020

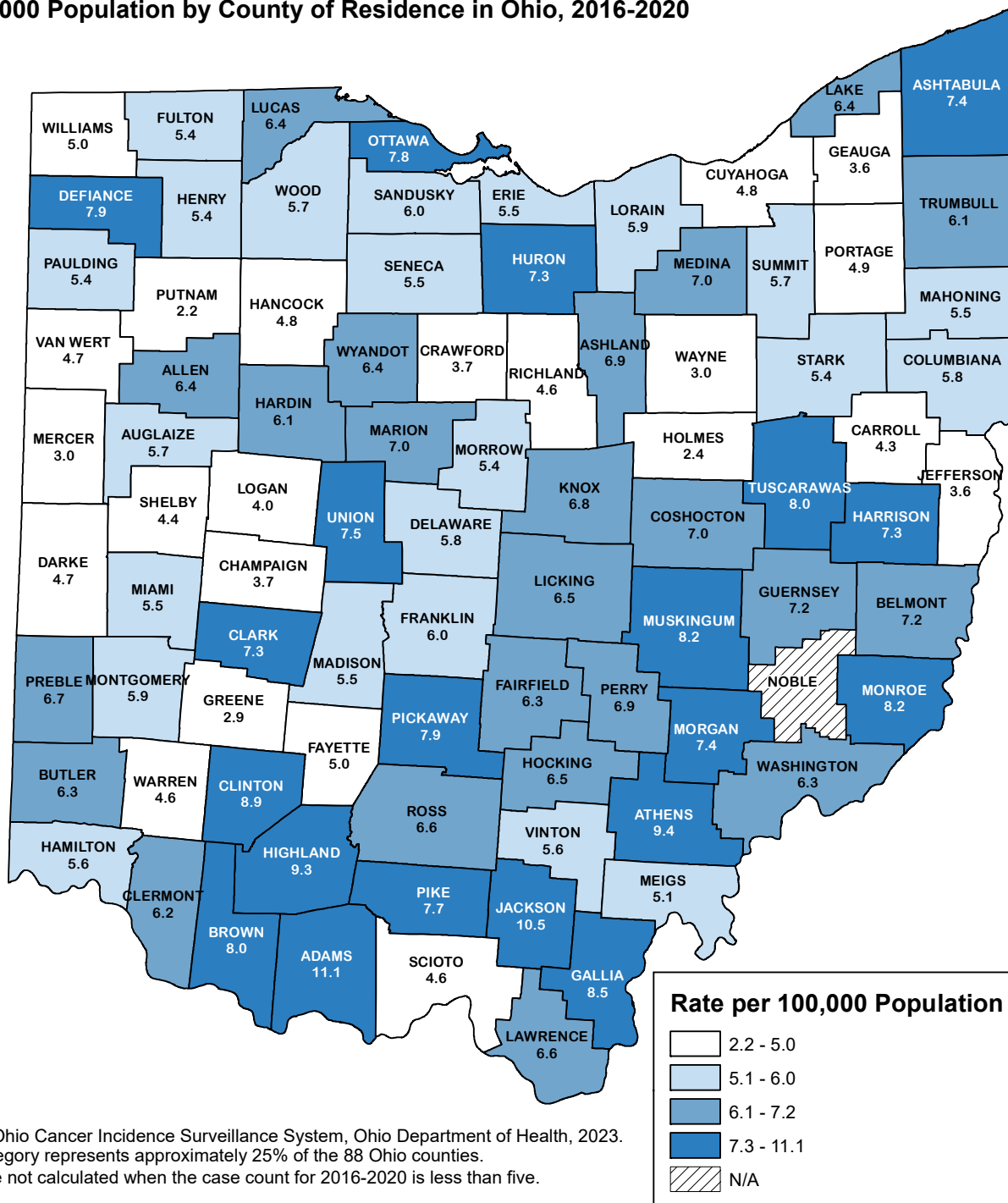


Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

HPV-Associated Oropharyngeal Cancer: Incidence by County

Figure 28 shows 2016-2020 average annual age-adjusted incidence rates for HPV-associated oropharyngeal cancer by county of residence. County-specific incidence rates in Ohio ranged from 2.2 to 11.1 per 100,000 population. The majority of counties with the highest incidence rates were located in southeastern Ohio.

Figure 28. HPV-Associated Oropharyngeal Cancer: Average Annual Age-Adjusted Incidence Rates per 100,000 Population by County of Residence in Ohio, 2016-2020

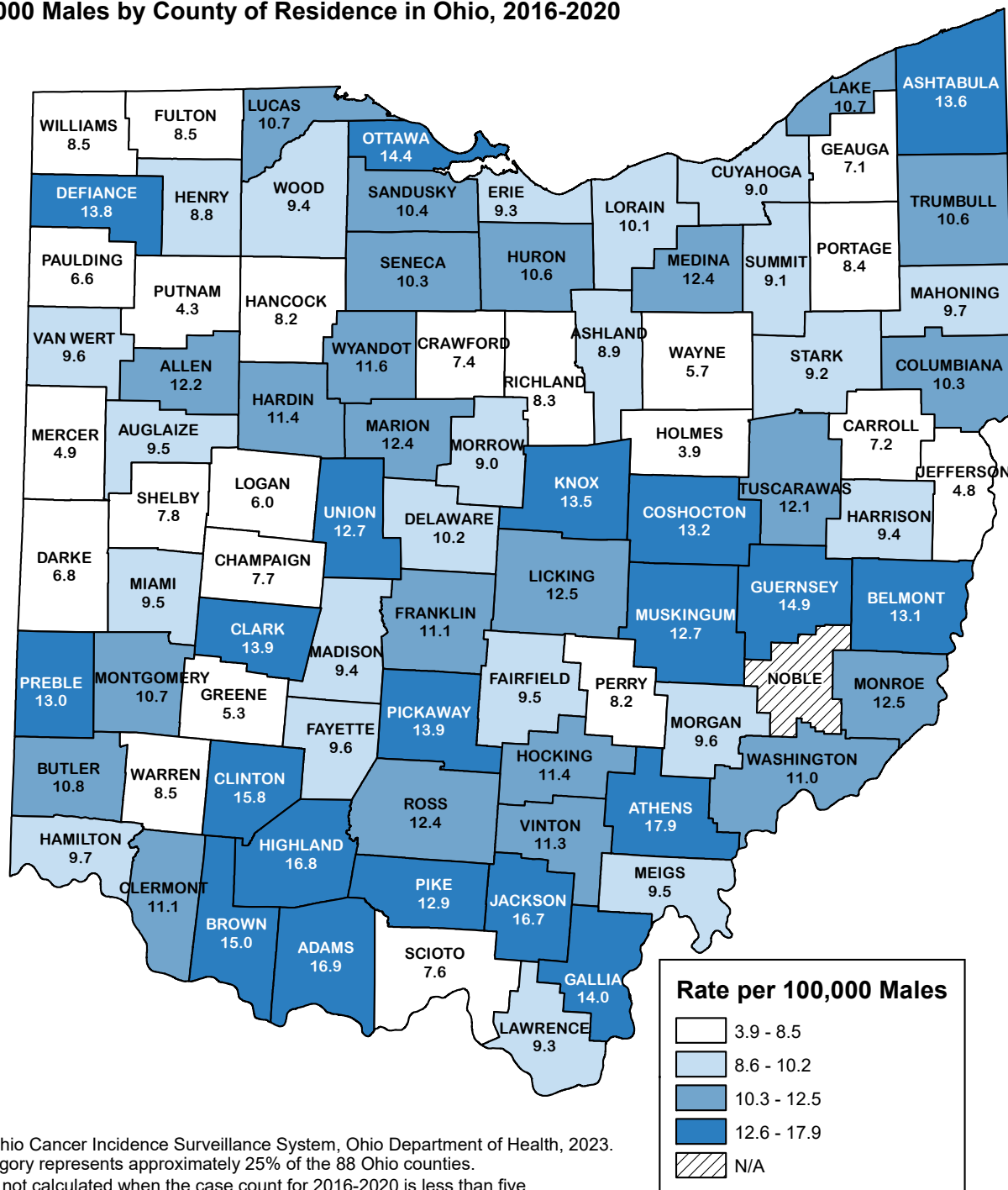


Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.
 Each category represents approximately 25% of the 88 Ohio counties.
 N/A: Rate not calculated when the case count for 2016-2020 is less than five.

HPV-Associated Oropharyngeal Cancer: Incidence Among Males by County

Figure 29 shows 2016-2020 average annual age-adjusted incidence rates for HPV-associated oropharyngeal cancer among males by county of residence. County-specific incidence rates ranged from 3.9 to 17.9 per 100,000 males. Because the majority of HPV-associated oropharyngeal cancer cases were male (83%), the distribution of oropharyngeal cancer cases among males is similar to that for males and females combined. The majority of counties with the highest incidence rates were located in southeastern Ohio.

Figure 29. HPV-Associated Oropharyngeal Cancer: Average Annual Age-Adjusted Incidence Rates per 100,000 Males by County of Residence in Ohio, 2016-2020

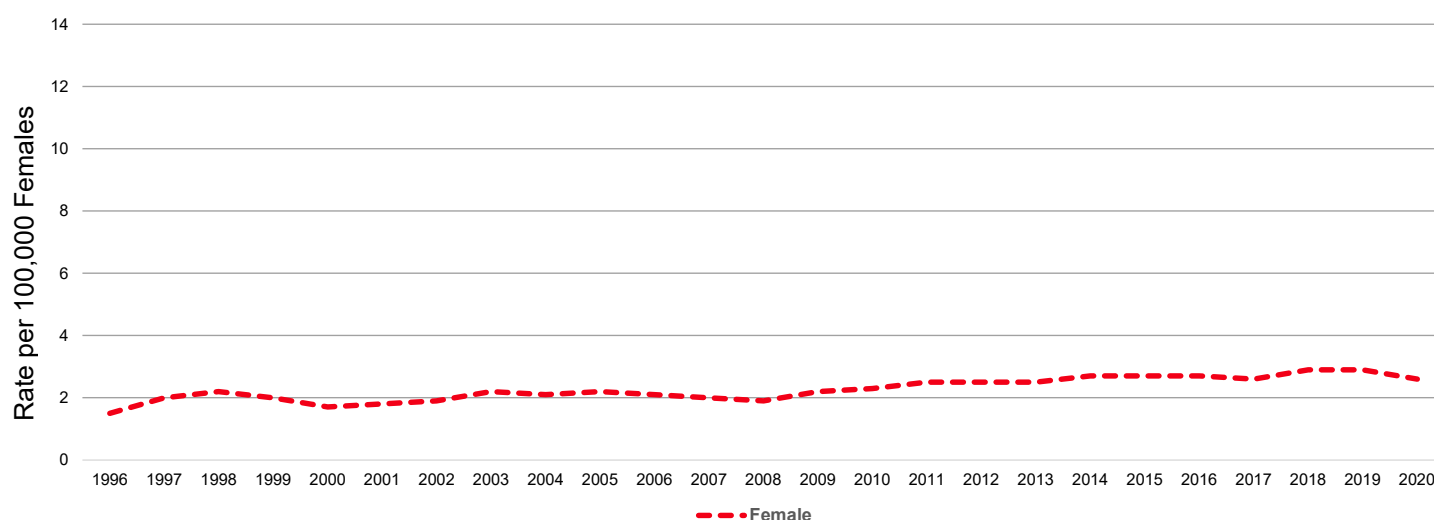


HPV-Associated Vulvar Cancer: Incidence Trends

Trends in incidence rates of vulvar cancer from 1996 to 2020 are shown in Figures 30-33.

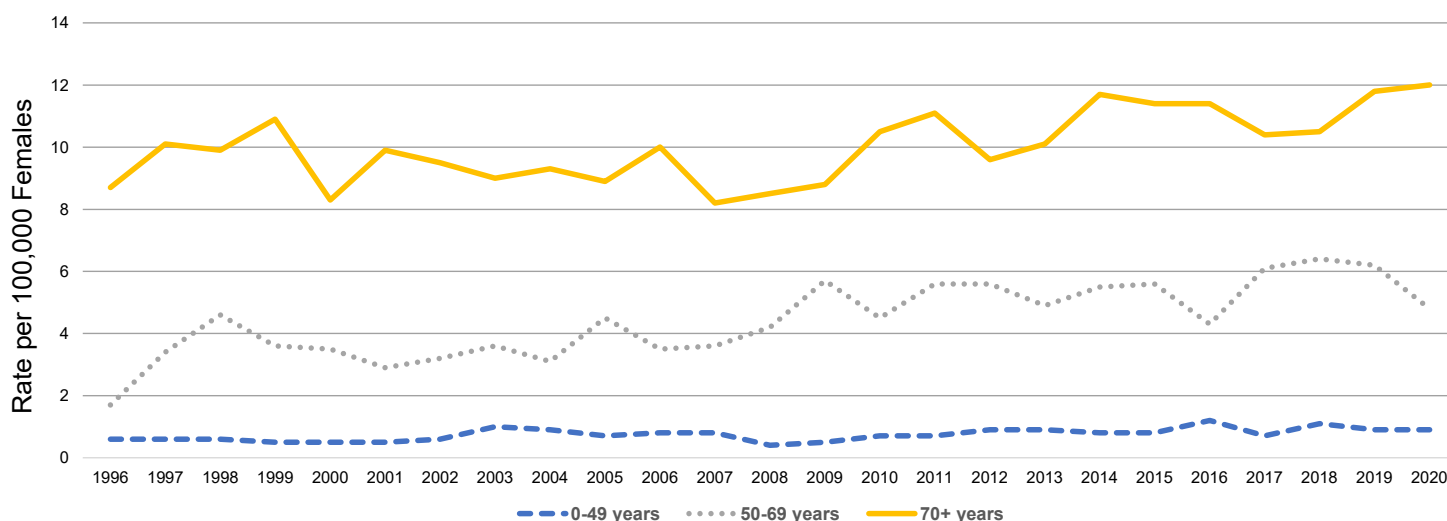
- The HPV-associated vulvar cancer incidence rate increased 80% from 1996 to 2020.
- The HPV-associated vulvar cancer incidence rate remained relatively stable for those 0-49 years old from 1996 to 2020, while the rate increased for those 50-69 years old and those 70 years old and older. For each year, the rate was highest among those 70 years old and older.

Figure 30. HPV-Associated Vulvar Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

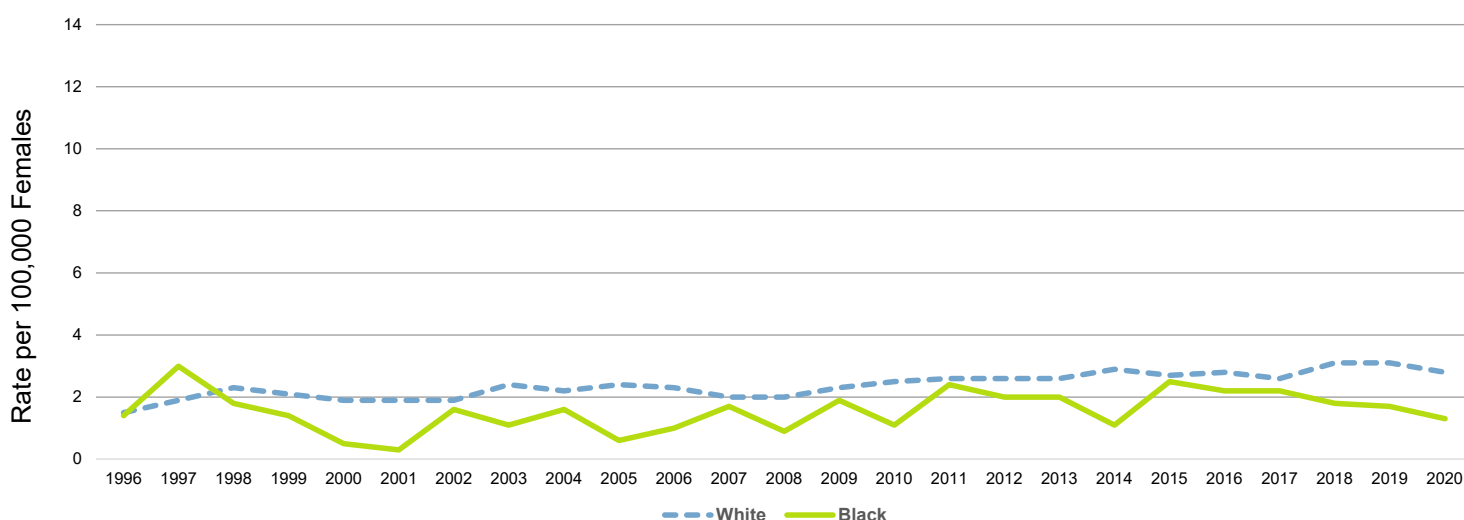
Figure 31. HPV-Associated Vulvar Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Age Group and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

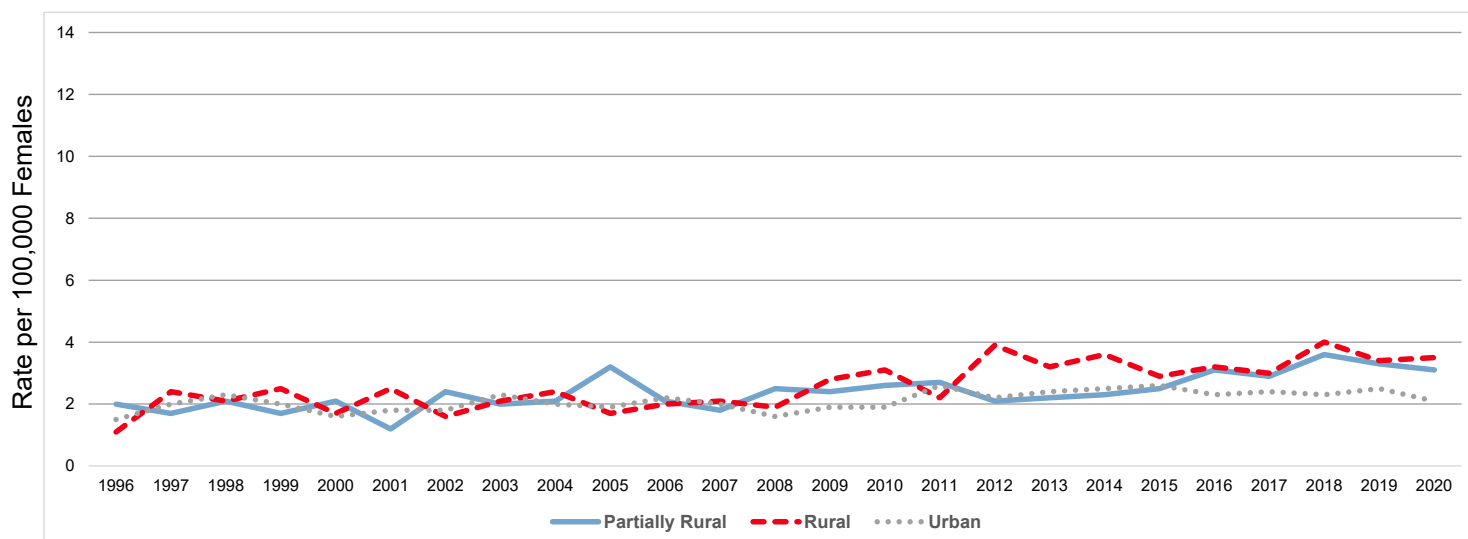
- The HPV-associated vulvar cancer incidence rate approximately doubled from 1996 to 2020 among White Ohioans, whereas the rate among Black Ohioans was more sporadic during the period due to smaller case counts.
- HPV-associated vulvar cancer incidence rates increased similarly in urban, rural, and partially rural counties of Ohio from 1996 to 2020.

Figure 32. HPV-Associated Vulvar Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Race and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 33. HPV-Associated Vulvar Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Females by Rurality and Year of Diagnosis in Ohio, 1996-2020



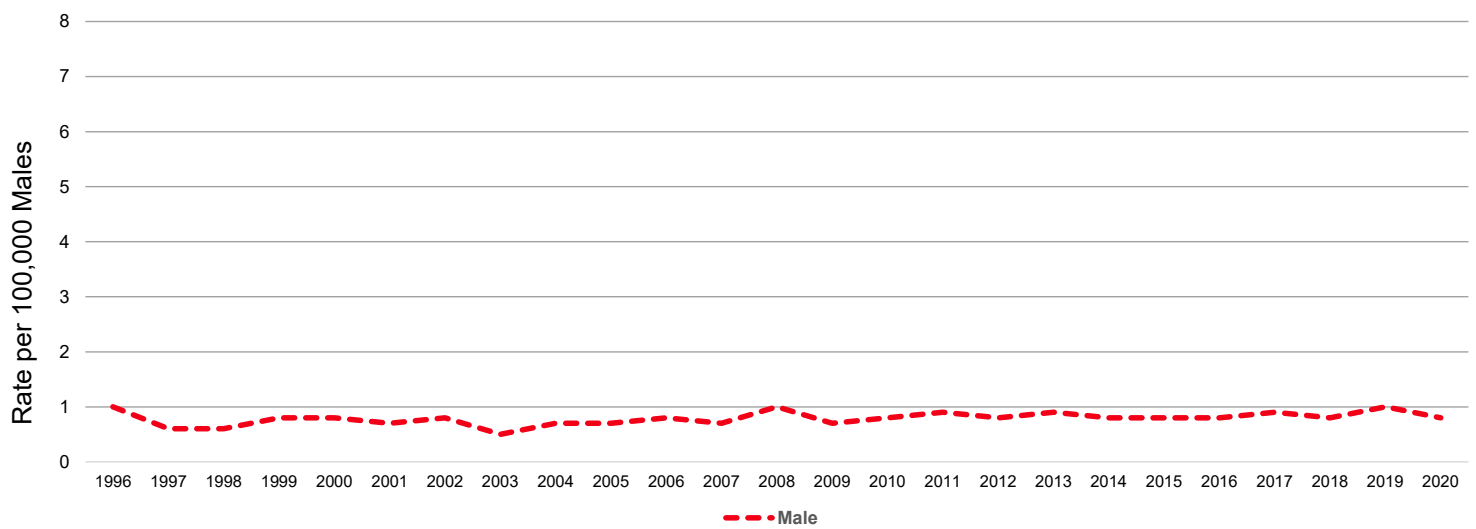
Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

HPV-Associated Penile Cancer: Incidence Trends

Trends in incidence rates of penile cancer from 1996 to 2020 are shown in Figures 34-37.

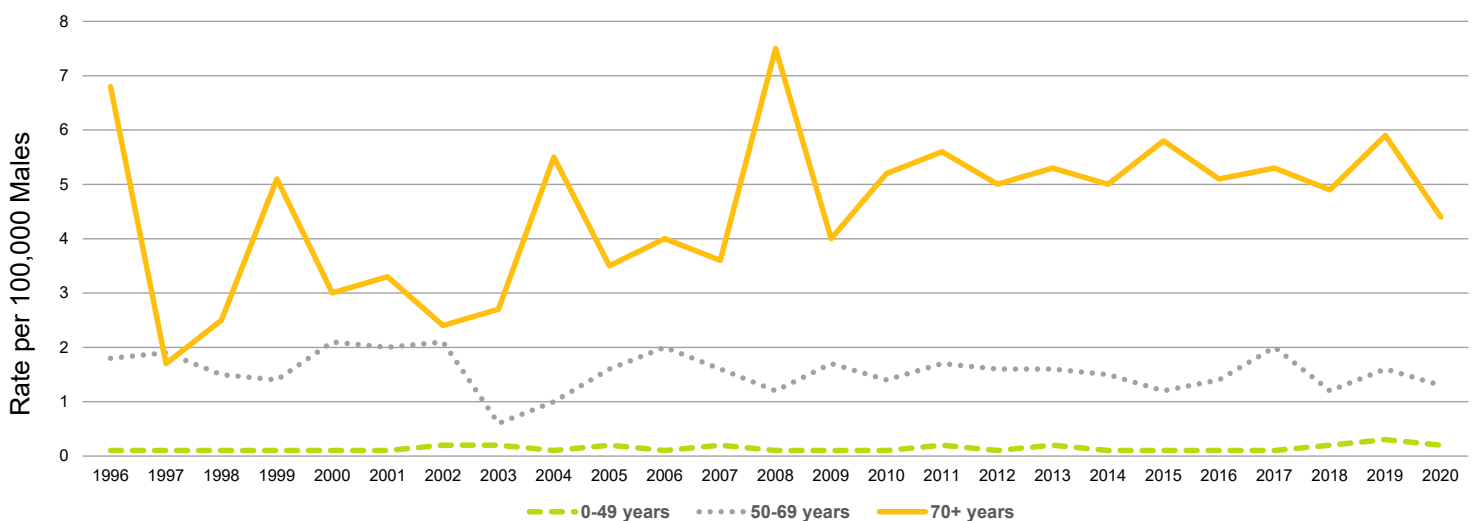
- The HPV-associated penile cancer incidence rate was stable from 1996 to 2020.
- The HPV-associated penile cancer incidence rate remained relatively stable for those 0-49 years old from 1996 to 2020, while the rate was sporadic indicating no clear trend for those 50-69 years old and those 70 years old and older. For almost all years, the rate was highest among those 70 years old and older.

Figure 34. HPV-Associated Penile Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Males by Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

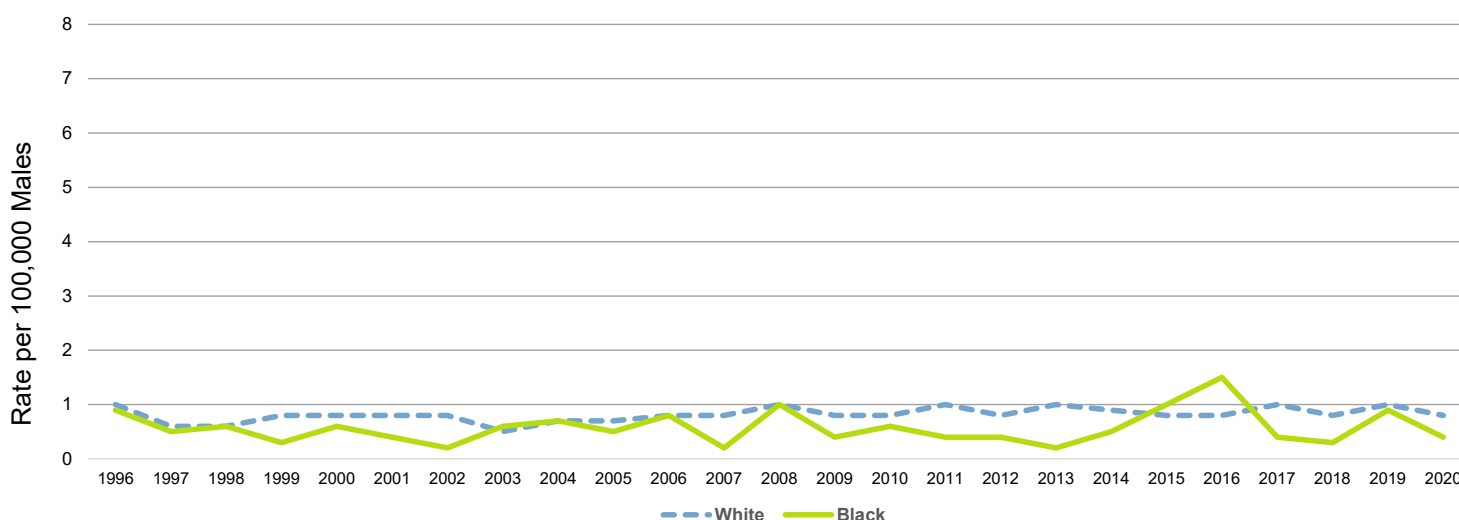
Figure 35. HPV-Associated Penile Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Males by Age Group and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

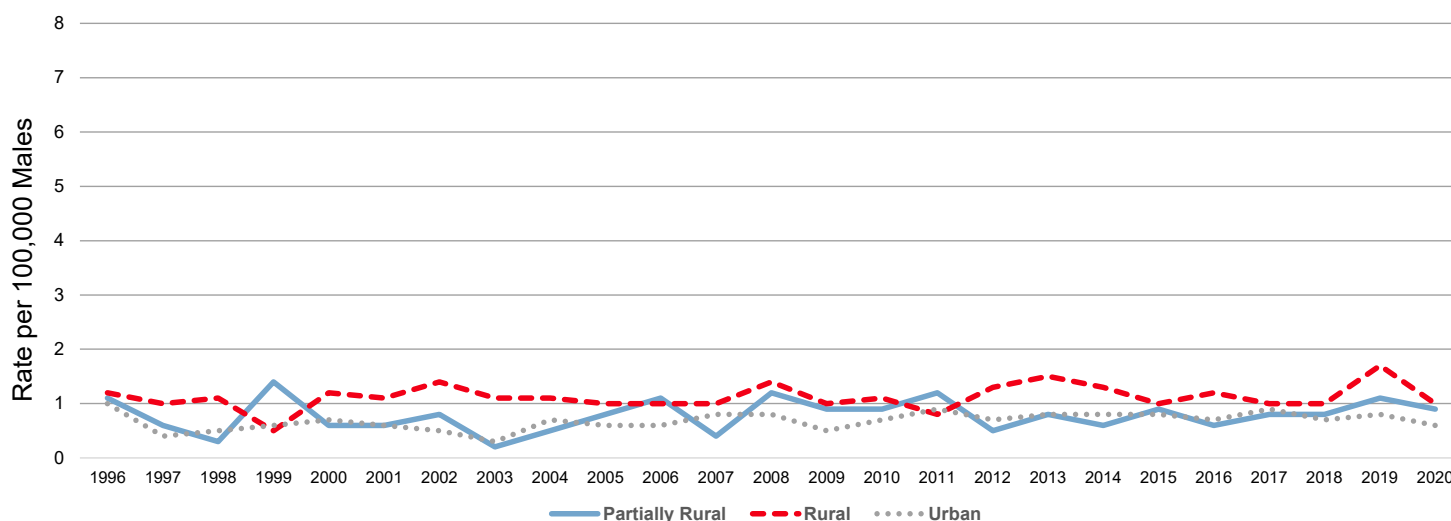
- HPV-associated penile cancer incidence rates were similar from 1996 to 2020 among White and Black men in Ohio. For a majority of years, rates were higher among White men, compared with Black men.
- HPV-associated penile cancer incidence rates were similar for urban and partially rural counties of Ohio from 1996 to 2020, while rates among rural counties were slightly higher for a majority of years.

Figure 36. HPV-Associated Penile Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Males by Race and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Figure 37. HPV-Associated Penile Cancer: Trends in Age-Adjusted Incidence Rates per 100,000 Males by Rurality and Year of Diagnosis in Ohio, 1996-2020



Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023.

Technical Notes

Age-Adjusted Rate: A summary rate that is a weighted average of age-specific rates, where the weights represent the age distribution of a standard population (direct adjustment). The incidence and mortality rates presented in this report were standardized to the age distribution of the 2000 U.S. Standard Population. Using the direct method, the population was first divided into 19 five-year age groups, i.e., <1, 1-4, 5-9, 10-14, 15-19...85+, and the age-specific rate was calculated for each age group. Each age-specific rate was then multiplied by the standard population proportion for the respective age group.

Average Annual Number: The number of cases diagnosed per year, on average, for the time period of interest (e.g., 2016-2020). Average annual numbers are calculated by summing the number of cases for a given time period, dividing by the number of years that comprise the time period and rounding to the nearest whole number.

Census Data: The 1996 to 2019 rates were calculated using population estimates from the U.S. Census Bureau and National Center for Health Statistics. Population data were compiled from bridged-race intercensal population estimates for July 1, 1990 to July 1, 1999 (released July 26, 2004); revised bridged-race intercensal population estimates for July 1, 2000 to July 1, 2004 (released Oct. 26, 2012); revised bridged-race intercensal population estimates for July 1, 2005 to July 1, 2009 (released June 26, 2014), and vintage 2020 bridged-race postcensal population estimates for July 1, 2010 to July 1, 2020 (released Sept. 22, 2021).

Incidence: The number of cases diagnosed during a specified time period (e.g., 2016-2020).

Invasive Cancer: A malignant tumor that has infiltrated the organ in which the tumor originated. Invasive cancers consist of those diagnosed at the localized, regional, distant, and unstaged/unknown stages. Only invasive cancers were included in the calculation of incidence rates in this document.

Rate: The number of cases per unit of population (e.g., per 100,000 females) during a specified time period (e.g., 2016-2020). Rates may be unstable and are not presented when the case count is less than five for a five-year period.

Table 4: HPV-Associated Cancer Site and Histology Codes
International Classification of Diseases for Oncology, Third Edition (ICD-O-3)

	ICD-O-3 Site Codes WHO 2008 Definition	ICD-O-3 Histology Codes
Cervical carcinoma	C530-C539	8010-8671, 8940-8941
Anal squamous cell carcinoma	C210-C218, C209	8050-8086, 8120-8131
Vaginal squamous cell carcinoma	C529	8050-8086, 8120-8131
Oropharyngeal squamous cell carcinoma	C019, C024, C028, C051-C052, C090-C091, C098-C099, C100-C104, C108-C109, C140, C142, C148	8050-8086, 8120-8131
Vulvar squamous cell carcinoma	C510-C519	8050-8086, 8120-8131
Penile squamous cell carcinoma	C600-C609	8050-8086, 8120-8131

Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2023, adapted from the International Classification of Diseases for Oncology, Third Edition, World Health Organization, Geneva, 2000.

*HPV-associated anal squamous cell carcinomas include rectal cancers (C209-C218).

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