Cancer in Minnesota, 1988-2015

REPORT TO THE MINNESOTA LEGISLATURE: FISCAL YEAR 2019

April 2019

Cancer in Minnesota, 1988-2015

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Contents

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Protecting, Maintaining and Improving the Health of All Minnesotans

April 24, 2019

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To the Honorable Chairs:

The Minnesota Department of Health (MDH) is pleased to release the fifteenth biennial report of the Minnesota Cancer Reporting System (MCRS) on the occurrence of cancer in Minnesota in accordance with Minnesota Statute 144.672, Subdivision 2.

This biennial report focuses on the trends in new cancer diagnoses (incidence) and cancer deaths (mortality) for all cancers combined and colorectal cancers occurring in Minnesota between 1988 and 2015. The report's findings suggest both successes in and opportunities for cancer prevention, control, and research in Minnesota. The most recent ten-year trends show that overall cancer incidence has fallen by 1.9 percent per year among males, but climbed 0.6 percent per year among females. Decreasing rates of common cancers for males (lung, prostate, and colorectal cancers) and increasing rates of lung cancer among females account for a large portion of these trends. Although trends show that mortality from all cancers is continuing to decline, cancer remains the leading cause of death in Minnesota. Ten-year trends in the incidence and mortality of colorectal cancers in Minnesota show substantial declines of 2.0 percent per year or more for males and females, providing evidence of our success in the early detection and treatment of this cancer. However, colorectal cancer incidence and mortality remain higher for some Minnesotans, including American Indian males and females, and Minnesotans

living in non-Metropolitan areas of the state compared with those living in the 7-County Metro. Trend data for Minnesota also suggest increasing incidence among younger adults, ages 20-49 years, which parallels national and international trends in colorectal cancer.

Our work to control cancer and reduce its impact in Minnesota is ongoing. Even if cancer rates decrease, the demands on health care services will continue to increase as the number of elderly Minnesotans increases with the aging of baby boom generation. MCRS will remain a critical resource for us to identify public health problems, accurately target resources, inform citizens and professionals about the risk of cancers, and promote high quality research. We encourage all organizations and individuals to join with us to reduce the cancer burden for all Minnesotans.

Sincerely,

Jan K. Malcolm
Commissioner
P.O. Box 64975
St. Paul, MN 55164-0975

Executive Summary

Minnesota Cancer Reporting System staff developed this report to describe the occurrence of cancer in Minnesota from 1988 through 2015, in accordance with Minnesota Statute 144.672 Subdivision 2. The report presents statistics for all cancers combined and colorectal cancers. Each section of the report includes cancer incidence and mortality rates and trends by age group, sex, race and ethnicity, and stage at diagnosis for incident colorectal cancers. Below is a summary of key findings:

In 2015, 29,847 Minnesotans were diagnosed with a new cancer and 10,242 Minnesotans died with cancer as the underlying cause of death. This means that, on average, about 82 Minnesota residents were diagnosed with a new cancer and 28 died from cancer every day in 2015.

- Four major cancer types were among the most common new cancers diagnosed and causes of cancer deaths overall: prostate (males), breast (females), lung and bronchus, and colorectal. Each of these cancers are strongly linked to modifiable lifestyle risk factors (e.g., smoking, diet, physical activity).

The total number of new cancers and cancer deaths is increasing even as cancer incidence (males only) and mortality rates for all cancers are decreasing. The state's changing demographics in population growth and population aging explain much of this pattern.

- In Minnesota, 87 percent of all cancers combined are diagnosed in people who are 50 or more years of age. As our state's baby boom population ages, we will witness an increasing number of family members, other relatives, neighbors, and friends develop and, unfortunately, die from some type of cancer.

Cancer rates are higher for some Minnesotans, suggesting the need for continued targeted, appropriate cancer prevention and control efforts.

- American Indian males and females had the highest incidence and mortality rates for both all cancers combined and colorectal cancers.
- Colorectal cancer incidence and mortality rates for Minnesotans living outside of the 7-County Metro are higher than for those living within the 7-County Metro area.

The trend for the most recent 10-years (2006-2015) shows that the rates for colorectal cancer are decreasing for Minnesotans age 50 or more years but are slightly increasing for Minnesotans ages 20-49 years, similar to the trends reported nationally for this age group. The increasing prevalence of obesity and possibly diabetes may be associated with the increased rates among younger adults.

Healthy People (HP) 2020 cancer mortality goals have not been met for:

- All cancer sites mortality (goal 161.4 deaths per 100,000):
  - American Indian males (329.0 deaths/100,000) and females (234.0 deaths/100,000);
  - black males (222.2 deaths/100,000); and
  - white non-Hispanic males (186.2 deaths/100,000)
- Colorectal cancer mortality (goal: 14.5 deaths/100,000):
  - American Indian males (36.9 deaths/100,000) and females (22.4 deaths/100,000);
  - white non-Hispanic males (14.8 deaths/100,000)

Introduction

Cancer is an umbrella term for more than 100 different diseases, each with different causes, treatments, and short- and long-term outcomes. Nevertheless, a hallmark of any cancer is uncontrolled cell growth and spread to distant sites in the body. A diagnosis of cancer can have serious, life-changing repercussions for cancer patients and their families. Fortunately, our understanding of cancer has improved over the past 100 years because of scientific advances in biology, genetics, medicine, public health, statistics, and related disciplines. From this research, cancer treatment and survival has improved. We are also better able to document and quantify the substantial health impacts of cancer in our state, communities, and families. Importantly, Minnesota public health professionals, clinicians, legislators, and associations like the Minnesota Cancer Alliance or the American Cancer Society (ACS) use scientific results and descriptive data on cancer occurrence to prioritize, plan, and fund cancer prevention and control activities in our state.

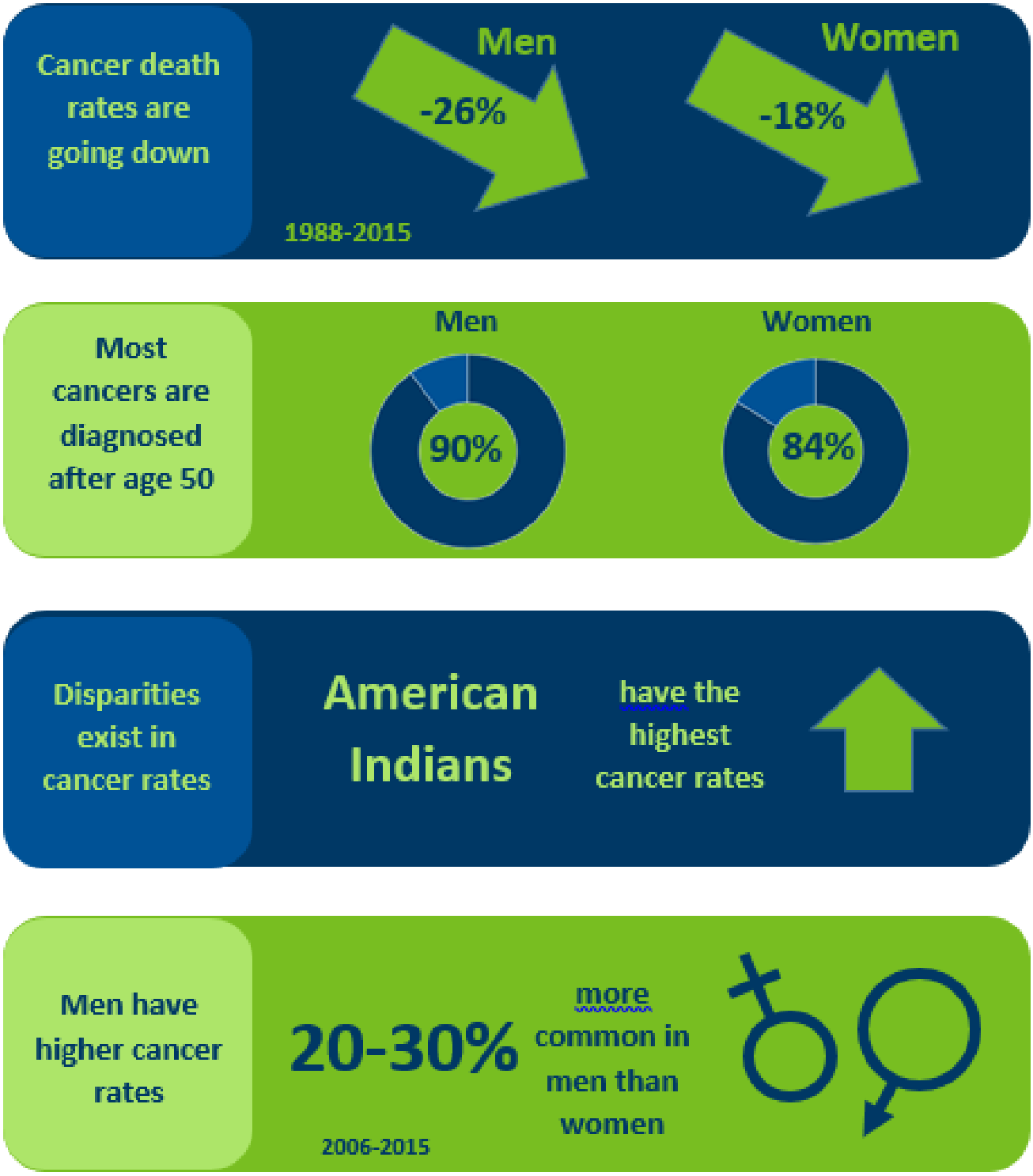
One indispensable source of data on cancer is the Minnesota Department of Health's Minnesota Cancer Reporting System (MCRS), formerly called the Minnesota Cancer Surveillance System. The 1987 Minnesota Legislature established this statewide cancer registry program to assure that accurate, complete, and timely data on cancer would be available to inform planning and decision-making at the local, state and national levels, as well as to foster research into the causes of different cancers. Enabling legislation also required a biennial report (Minnesota Statute 144.672, Subdivision 2) to describe cancer incidence and discuss the public health significance of cancer in Minnesota. MCRS collects cancer and demographic data on Minnesotans who have a newly diagnosed cancer from hospitals, clinics, and pathology laboratories in accordance with Minnesota statutes and rules including those for data protection and privacy. The registry program has been in operation since 1988 and has been a member of the CDC's National Program of Central Cancer Registries since 1995.

The need for data-informed programs and policy takes on added importance as the number of cancer diagnoses continues to increase over time because of population growth and the aging of the baby boom generation. Based on preliminary (unpublished) MCRS analyses, by 2037, changes in both population growth and aging could result in a 50 percent increase in the number of new cancers diagnosed in Minnesotans. Cancer prevention, intervention, and control programs carried out now promise to reduce the anticipated increase of cancer incidence in the years to come. MCRS data will be critically important to help guide planning and resource allocation in response to the increased cancer burden, as well as to reduce the persistent health disparities in Minnesota.

This report fulfills requirements for a biennial report (M.S. 144.672, as mentioned above) and MCRS objectives for CDC-RFA-DP17-1701 funding of the National Program of Cancer Registries (NPCR). It describes the total cancer burden from all cancers combined in Minnesota and contains a section on the incidence and mortality of colorectal cancer. We present descriptive statistics by cancer stage, age group, sex, race and ethnicity, and describe trends in the cancer incidence and mortality rates over time. We included Centers for Disease Control and Prevention's Healthy People 2020 (HP2020) (https://www.cdc.gov/nchs/healthy_people/hp2020.htm) objectives for colorectal cancer to support cancer prevention and control programs across Minnesota. In the body of the report, we embedded numerous links to detailed technical information located primarily, but not exclusively in the Resource Section. This section contains brief descriptions and links to registry methods, data standards, MCRS legal authority and data privacy, statistical methods, and a glossary of terms used. It also contains other links to MCRS and US cancer statistics. The appendices provide additional information, including incidence and mortality trend data for the 28-year period (Appendix A) and an overview of MCRS data use in

research and public health practice (Appendix B). We included a brief evaluation form to obtain feedback on this report and input on what readers would like to see in future MCRS reports (Appendix C). Finally, Supplement 1 Maps and Data (PDF) (http://www.health.state.mn.us/data/mcrs/docs/2019biensupa.pdf) provides maps showing cancer incidence and mortality statistics for Minnesota counties and for State Community Health Services Advisory Committee (SCHSAC) (https://www.health.state.mn.us/communities/practice/schsac/index.html) geographic regions. Supplement 2 Publications and Data Use (PDF) (http://www.health.state.mn.us/data/mcrs/docs/2019biensupb.pdf) provides a list of selected reports and publications that used MCRS data in public health practice and research. Both supplements are available online.

Statistics Snapshot-All Sites Combined



All Cancers Combined

Different cancers have different causes, treatments, and long- and short-term outcomes, but all cancers start with the uncontrolled growth of cells at a specific location or site within the body. The site where the cancer first started usually identifies the cancer type. For example, abnormal cells that started growing in the breast are called breast cancers. Unfortunately, cancer cells are able to spread to distant sites, away from where the cancer first started and this can have serious impacts on a person's health, and their family and community.

Cancer is common

Cancers are much more common than most people realize, especially when considered in terms of lifetimes rather than as a yearly rate. Using current Minnesota cancer rates and average life expectancies, we estimate that about four or five people out of ten will be diagnosed with some type of cancer at some point in their lifetimes. Most of this "lifetime" risk of cancer occurs as we get older because cancer rates rise sharply with age. As we and our families, friends, and neighbors advance into middle age and beyond, we will begin to witness an increasing number of family members, other relatives, neighbors, and friends develop and, unfortunately, die from some type of cancer.

Burden of cancer incidence and mortality in Minnesota

Examining the trends in the incidence and mortality of all cancers combined is useful in describing the overall cancer burden in a population. This will give us a partial answer to the question, "How large of a public health problem is cancer in Minnesota?" It is important to keep in mind that the overall trend for all cancer sites combined represents the net change in trends for all individual cancer types, some of which are increasing, decreasing or remaining stable over the same year or group of years. In addition, because different cancers have different causes, in looking at trends for cancer in all sites combined we will not be able to gain an understanding of the factors that are linked to an increase or decrease in the chance of developing any individual cancer.

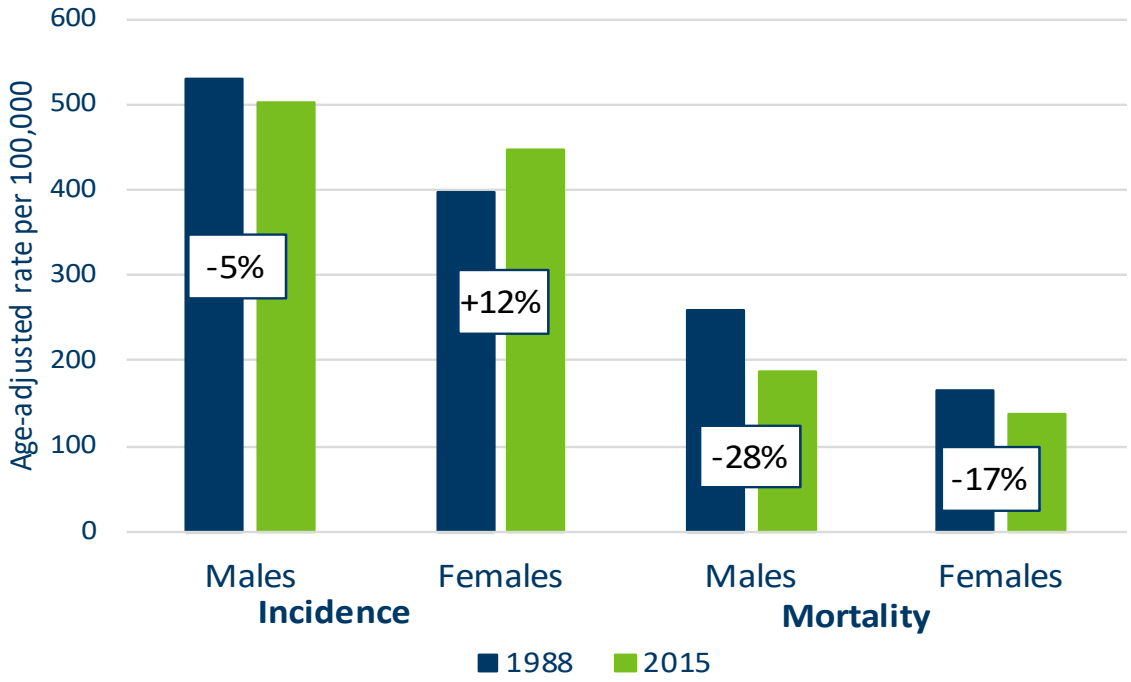
Examining the patterns of all cancers combined by population demographics (for example, sex, race and ethnicity, and age) broadens our understanding of cancer as a public health problem. The number and rates of different cancers are different in males and females. Differences in the number of cancers and rates also exist by racial and ethnic groups, as well as by age groups. Understanding these differences can be helpful in developing effective and culturally appropriate cancer prevention and control programs. The tables and figures below display the patterns in cancer incidence and mortality for all sites combined overall and by sex, race and ethnicity and age group in Minnesota between 1988 and 2015, unless otherwise noted.

Changes in all cancers combined between 1988 and 2015 for males and females

The chart below and tables of trend data (Appendix A) show that while the total number of new cancers and cancer deaths increased in Minnesota, the overall incidence and mortality rates for all cancers combined decreased between 1988 and 2015.

- The number of new cancers diagnosed in males and females increased at least 65 percent between 1988 and 2015, from 9,147 to 15,104 in males and from 8,851 to 14,743 in females. The increase in the number of new cancers diagnosed in males and females during this time reflects both population growth and population aging, as well as the net effect of changes in the factors that increase or decrease the chance of a new cancer diagnosis in Minnesota, as mentioned above.
- Over the 28-year period from 1988 to 2015, the number of males and females who died from cancer increased at least 25 percent, from 4,205 to 5,352 in males and from 3,895 to 4,890 in females. Minnesota's changing population demographics, notably population growth and aging, largely explain the increased number of cancer deaths among males and females.
- Compared with 1988, the age-adjusted incidence rate for all cancers decreased 5 percent for males but increased 12 percent for females in 2015. Decreasing rates of the most common cancers in males – lung, prostate and colorectal cancers – have contributed to the decline in the incidence rate for all cancers combined for males. Increases in the rate of lung cancer among females explains, in part, why the rate for all cancers combined has increased for females since 1988.
- From 1988 to 2015, the mortality rate for all cancers decreased 28 percent for males and 17 percent for females. The decline in cancer mortality over this time reflects the impact of early cancer detection and screening, improvements in cancer therapies and supportive care, and other factors (1).

Percent change in incidence and mortality for all cancers combined, 1988-2015

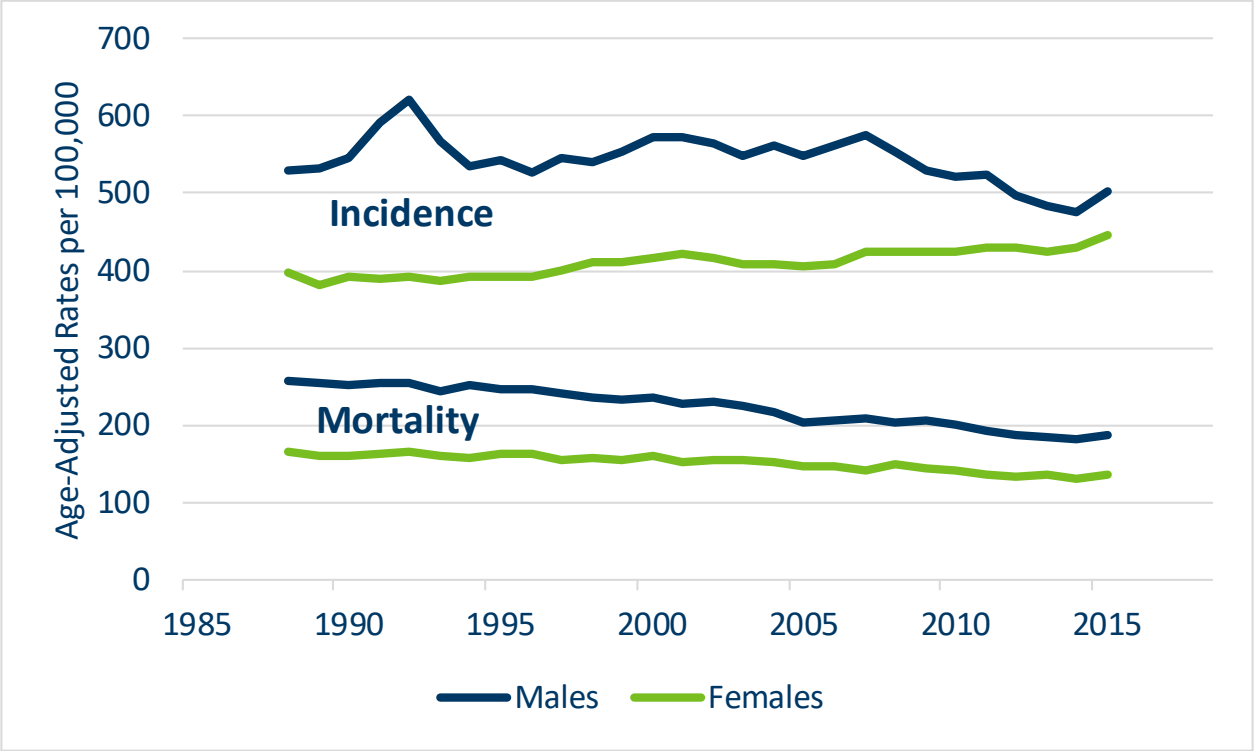


Trends in all cancers combined in Minnesota, 1988-2015

The chart below shows the trends in age-adjusted cancer incidence and mortality for Minnesota males and females during 1988-2015 (Appendix A).

- Since 1988, cancer incidence rates for Minnesota males fluctuated up and down. By 2015, the trend in the rate for males showed a net decrease. In the last ten years cancer incidence rates for males decreased by 1.9 percent per year. The age-adjusted incidence rates for females gradually increased during this time. In the last 10 years cancer incidence rates for females increased by 0.6 percent per year.
- Over the 28-year period, cancer mortality rates for males and females have steadily decreased. In the last ten years cancer mortality rates decreased for males by 1.6 percent per year and 1.1 percent per year for females.

Incidence and mortality rates for all cancers combined, 1988-2015



Common types of cancer in Minnesota for males and females

The tables below show the 10 most common new cancer diagnoses and the 10 most common cancer causes of death in Minnesota males and females.

- The types of new cancers that males and females are most commonly diagnosed with are not exactly the same as the most common causes of cancer death. Nonetheless, lung and colorectal cancers account for 20 percent of new cancer diagnoses and about 33 percent of deaths in both males and females. Additionally, cancer of the prostate is a common new diagnosis and cause of death for Minnesota males, while cancer of the breast is a common new diagnosis and cause of death for Minnesota females.
- The incidence of some cancers is low but the mortality rate is high, testifying to poor survival from these cancers. Pancreatic cancer is the 10th most common incident cancer diagnosed in males and females but it is the 4th most common cancer cause of death in both sexes. Similar examples include brain and other nervous system cancers in females, and liver and intrahepatic bile duct cancers in both males and females. These cancers do not rank among the 10 most common incident cancers but they are one of the 10 most common causes of cancer deaths.
- Finally, some cancers are among the 10 most common cancers diagnosed in Minnesota but they are not among the 10 most common cancer causes of death. Examples include thyroid cancer in women, and cancers of the oral cavity and pharynx in men.

Top 10 Incident cancers in males, 2015

Cancer	Rate/100,000	Number of cases	Percent of total
Prostate	112.1	3,633	24.1%
Lung and Bronchus	62.8	1,865	12.3%
Colon and Rectum	43.2	1,262	8.4%
Urinary Bladder	38.1	1,087	7.2%
Melanoma of the Skin	37.1	1,090	7.2%
Non-Hodgkin Lymphoma	27.2	784	5.2%
Kidney and Renal Pelvis	23.9	724	4.8%
Leukemia	22.4	647	4.3%
Oral Cavity and Pharynx	16.3	517	3.4%
Pancreas	15.1	447	3.0%
All Cancers Combined		15,104	

Top 10 incident cancers in females, 2015

Cancer	Rate/100,000	Number of cases	Percent of total
Breast	134.9	4,380	29.6%
Lung and Bronchus	53.4	1,858	12.6%
Colon and Rectum	33.9	1,136	7.7%
Uterus	31.7	1,098	7.4%
Melanoma of the Skin	28.3	866	5.9%
Thyroid	18.7	530	3.6%
Non-Hodgkin Lymphoma	17.4	588	4.0%
Leukemia	12.3	404	2.7%
Pancreas	12.3	432	2.9%
Kidney and Renal Pelvis	12.1	399	2.7%
All Cancers Combined		14,783	

Top 10 cancers causes of death in males, 2015

Cancer	Rate/100,000	Number of deaths	Percent of total
Lung and Bronchus	43.0	1,250	23.4%
Prostate	20.5	543	10.1%
Colon and Rectum	14.8	421	7.9%
Pancreas	12.9	378	7.1%
Leukemia	9.8	276	5.2%
Liver and Intrahepatic Bile Duct	8.4	265	5.0%
Non-Hodgkin Lymphoma	8.2	227	4.2%
Urinary Bladder	7.2	199	3.7%
Esophagus	7.1	223	4.2%
Brain and Other Nervous System	6.3	189	3.5%
All Malignant Cancer Deaths		5,352	

Top 10 cancer causes of death in females, 2015

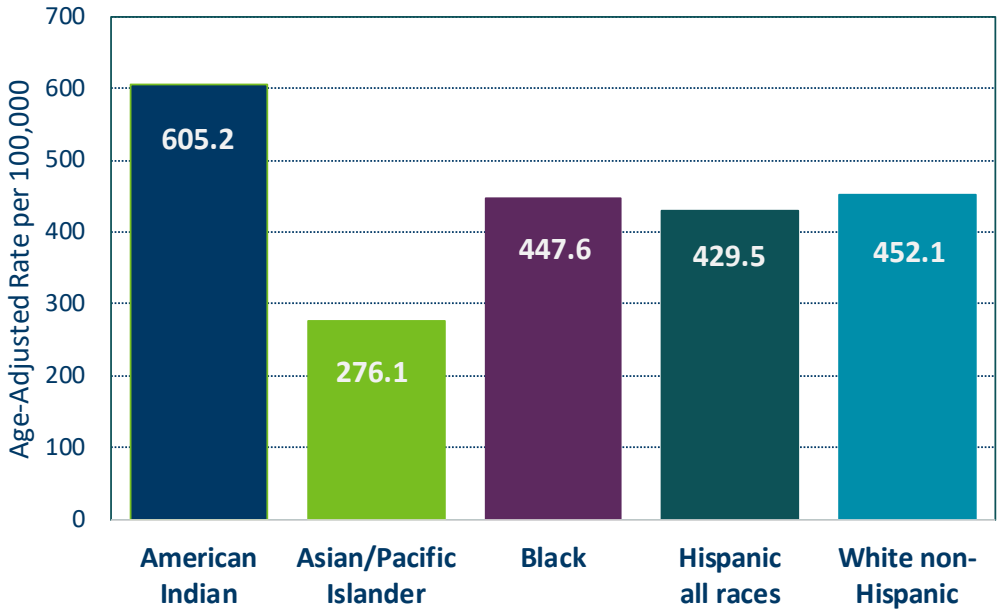
Cancer	Rate/100,000	Number of deaths	Percent of total
Lung and Bronchus	34.3	1,185	25.8%
Breast	16.9	589	12.8%
Colon and Rectum	11.1	395	8.6%
Pancreas	8.8	310	6.7%
Ovary	6.4	222	4.8%
Leukemia	5.2	187	4.1%
Non-Hodgkin Lymphoma	4.2	145	3.2%
Uterus	4.1	144	3.1%
Brain and Other Nervous System	3.7	117	2.5%
Liver and Intrahepatic Bile Duct	3.4	124	2.7%
All Malignant Cancer Deaths		4,890	

Incidence of all cancers combined by race and ethnicity

The chart and table below show the greater burden of overall cancer incidence in American Indian males and females compared to Minnesotans of other races and ethnic groups.

- Overall and by sex, American Indians had the highest rate of new cancers diagnosed and Asian and Pacific Islanders had the lowest incidence rate during 2011-2015. The overall incidence rate for American Indians was more than double the rate for Asian and Pacific Islanders.
- The incidence rate for American Indian males was 2.4 times the rate for Asian and Pacific Islander males, and between 1.3 and 1.5 times the rates for males of the other racial and ethnic groups. The incidence rate for American Indian females was double the rate for Asian and Pacific Islander females, and between 1.3 and 1.5 times the rates for females of the other racial and ethnic groups.

Incidence rates for all cancers combined by race/ethnicity, 2011-2015



Race/ethnicity	Total Rate	Count	Male Rate	Count	Female Rate	Count
American Indian	605.2	1,523	655.9	749	569.7	774
Asian/Pacific Islander	276.1	2,156	274.1	902	281.7	1,254
Black	447.6	4,138	518.1	2,214	391.8	1,924
Hispanic all races	429.5	2,296	428.0	1,026	440.0	1,270
White non-Hispanic	452.1	127,540	489.1	64,873	427.6	62,667
All Races Combined	457.2	140,291	495.6	71,208	431.6	69,083

Common types of cancers in Minnesota differ by race and ethnicity

As seen in the tables below, the most common new cancer diagnoses are not exactly the same by race and ethnicity for both males and females.

Top 10 incident cancers for males by race/ethnicity, 2011-2015

Rank	White-Non Hispanic	Black	American Indian	Asian/Pacific Islander	Hispanic-All races
1	Prostate	Prostate	Lung	Prostate	Prostate
2	Lung	Lung	Prostate	Lung	Lung
3	Colorectal	Colorectal	Colorectal	Colorectal	Colorectal
4	Bladder	Liver	Kidney	Liver	Bladder
5	Melanoma	Kidney	Oral	Non-Hodgkin Lymphoma	Liver
6	Non-Hodgkin Lymphoma	Bladder	Bladder	Stomach	Non-Hodgkin Lymphoma
7	Kidney	Non-Hodgkin Lymphoma	Leukemia	Bladder	Kidney
8	Leukemia	Pancreas	Liver	Oral	Leukemia
9	Oral	Oral	Non-Hodgkin Lymphoma	Pancreas	Stomach
10	Pancreas	Stomach	Stomach	Kidney	Oral

Top 10 incidence cancers for females by race/ethnicity, 2015

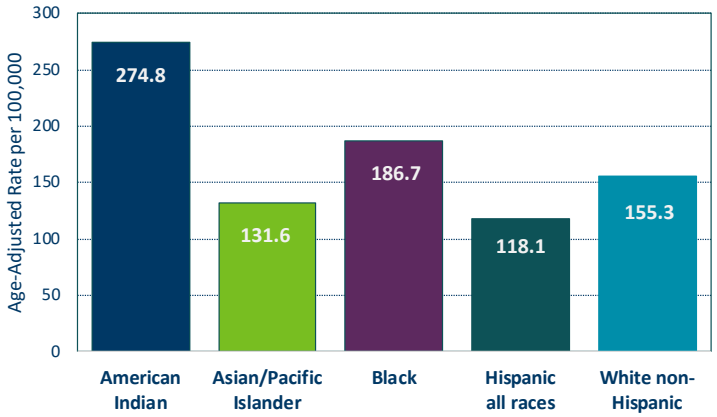
Rank	White-Non Hispanic	Black	American Indian	Asian/Pacific Islander	Hispanic-All races
1	Breast	Breast	Breast	Breast	Breast
2	Lung	Lung	Lung	Colorectal	Colorectal
3	Colorectal	Colorectal	Colorectal	Lung	Uterus
4	Uterus	Uterus	Uterus	Thyroid	Lung
5	Melanoma	Thyroid	Non-Hodgkin Lymphoma	Uterus	Thyroid
6	Thyroid	Pancreas	Kidney	Non-Hodgkin Lymphoma	Non-Hodgkin Lymphoma
7	Non-Hodgkin Lymphoma	Non-Hodgkin Lymphoma	Thyroid	Cervix	Leukemia
8	Leukemia	Kidney	Pancreas	Leukemia	Kidney
9	Kidney	Liver	Ovary	Pancreas	Pancreas
10	Ovary	Myeloma	Bladder	Stomach	Ovary

Mortality of all cancers combined by race and ethnicity

The chart and table below show the disproportionate burden of cancer mortality in American Indian males and females compared to Minnesotans of other races and ethnic groups.

- Overall and by sex, American Indians had the highest overall cancer mortality rate. Hispanics of all races, and Asian and Pacific Islanders had the lowest overall cancer mortality rates.
- Black Minnesotans had the second highest cancer mortality rate in the state between 2011 and 2015. For both sexes, the cancer mortality rate for black Minnesotans was greater than the rates for whites, Hispanics of all races, and Asian and Pacific Islanders.
- The mortality rate for American Indian males was 2.5 times the mortality rate for Hispanic males of all races, and between 1.5 and 2.2 times greater than the mortality rates for males of all other racial and ethnic groups. The mortality rate for American Indian females was 2.2 times the mortality rate for Hispanic females, and between 1.5 and 1.9 times greater than the mortality rates for females of all other racial and ethnic groups.
- Overall, the HP2020 goal for all cancer mortality has not been met for American Indian and black Minnesotans. By sex, the HP2020 goal for mortality for all sites has not been met for American Indian males and females, and for black or white males.

Mortality rates for all cancers combined by race/ethnicity, 2011-2015



Race	Total Rate	Count	Male Rate	Count	Female Rate	Count
American Indian	274.8	575	329.0	306	234.0	269
Asian/Pacific Islander	131.6	868	148.0	415	120.5	453
Black	186.7	1,353	222.2	719	160.2	634
Hispanic all races	118.1	486	130.7	259	107.1	227
White non-Hispanic	155.3	45,251	186.2	23,644	133.5	21,607
All Races Combined	155.9	48,371	186.6	25,265	134.2	23,106

Healthy People 2020 cancer mortality goal: 161.4 deaths/100,000

Common types of cancer deaths in Minnesota differ by race and ethnicity

The tables below show that for both males and females, the most cancer causes of death are not exactly the same by race and ethnicity.

Top 10 cancer causes of death for males by race/ethnicity, 2011-2015

Rank	White	Black	American Indian	Asian/Pacific Islander	Hispanic-All races
1	Lung	Lung	Lung	Lung	Prostate
2	Prostate	Prostate	Colorectal	Liver	Lung
3	Colorectal	Liver	Prostate	Prostate	Liver
4	Pancreas	Pancreas	Leukemia	Colorectal	Pancreas
5	Leukemia	Colorectal	Liver	Pancreas	Colorectal
6	Non-Hodgkin Lymphoma	Leukemia	Pancreas	Non-Hodgkin Lymphoma	Esophagus
7	Esophagus	Oral	Kidney	Stomach	Stomach
8	Liver	Kidney	Esophagus	Leukemia	Kidney
9	Bladder	Bladder	Non-Hodgkin Lymphoma	Bladder	Non-Hodgkin Lymphoma
10	Kidney	Esophagus	Stomach	Oral	Oral

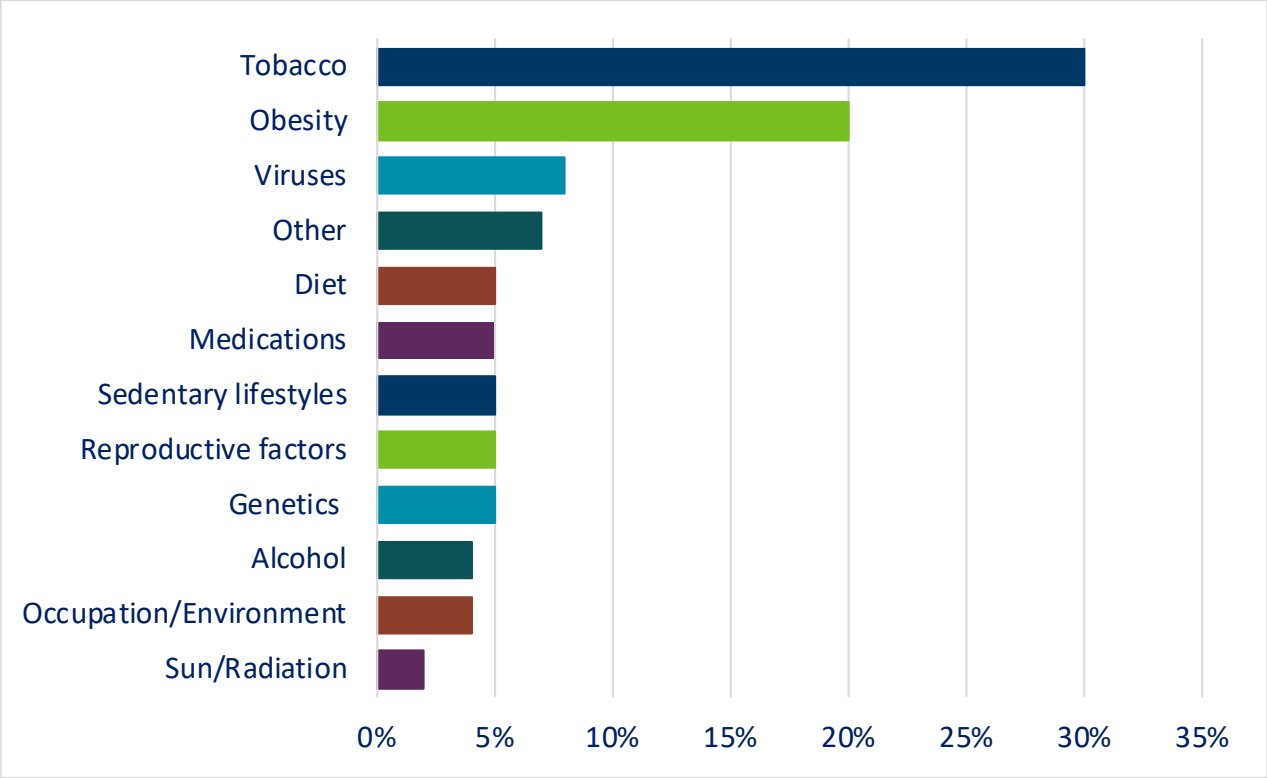
Top 10 cancer causes of death in females by race/ethnicity, 2015

Rank	White	Black	American Indian	Asian/PI	Hispanic-All races
1	Lung	Lung	Lung	Lung	Lung
2	Breast	Breast	Colorectal	Colorectal	Breast
3	Colorectal	Pancreas	Breast	Liver	Colorectal
4	Pancreas	Colorectal	Oral	Breast	Pancreas
5	Ovary	Liver	Liver	Pancreas	Leukemia
6	Leukemia	Uterus	Pancreas	Cervix	Non-Hodgkin Lymphoma
7	Non-Hodgkin Lymphoma	Myeloma	Stomach	Stomach	Liver
8	Uterus	Esophagus	Non-Hodgkin Lymphoma	Non-Hodgkin Lymphoma	Uterus
9	Brain	Ovary	Leukemia	Leukemia	Stomach
10	Liver	Stomach	Kidney	Uterus	Myeloma

Risk factors and screening

It is not possible to pinpoint exactly what caused an individual's cancer, but research has shown that age, genetics, obesity, certain exposures, and behaviors increase or decrease the chances of developing cancer. To learn more about how sex, age, and race might affect the chances of developing and dying from cancer and other conditions, go to National Cancer Institute's interactive online tool: Know Your Chances (https://knowyourchances.cancer.gov/). While we have no control over our age, race, family history, and genetics, much of our cancer risk is strongly influenced by lifestyle factors that we can control (2, 3, 4, 5). Such modifiable lifestyle risk factors include cigarette smoking, obesity, alcohol consumption, ionizing and solar radiation, certain infectious agents (for example, hepatitis and human papilloma viruses), occupation, and physical inactivity (See chart below). Those factors account about 60 percent of cancer deaths in the U.S. Other lifestyle factors that increase risk include reproductive patterns, sexual behavior, and medications.

Estimate of U.S. cancer mortality attributable to various known risk factors (3)

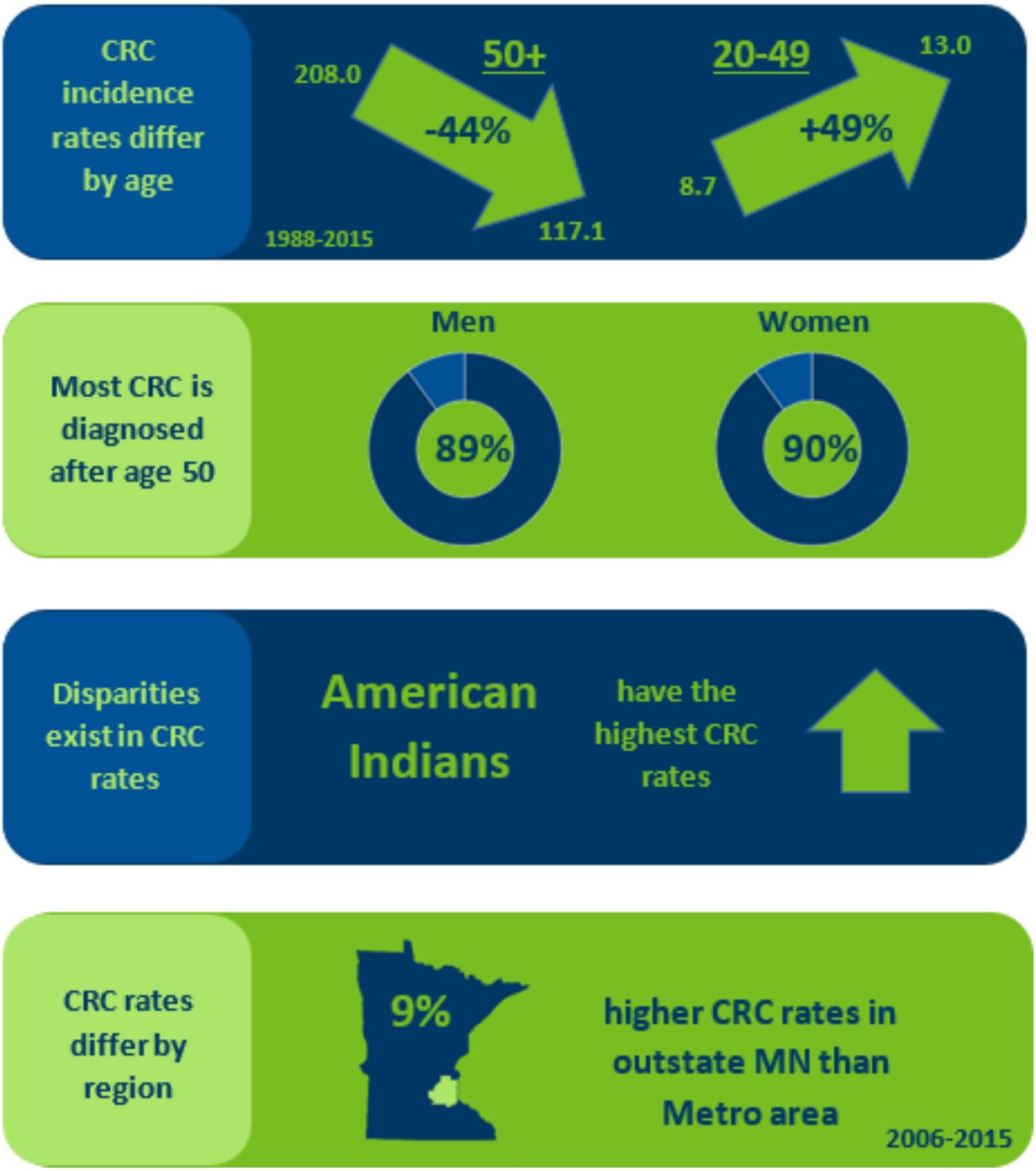


Screening for certain cancers in people who do not already show signs or symptoms of cancer can reduce the risk of dying from those cancers. The goal of screening is to identify and treat specific cancers early in the course of disease, when treatment is usually more effective compared to when they have spread to distant sites in the body. If the screening procedure removes an in situ cancer or pre-cancerous tissue from the cervix, breast, colon, or rectum, the procedure can prevent the cancer from occurring altogether. The U.S. Preventive Services Task Force (USPSTF) and the American Cancer Society (ACS) are two organizations in the US that develop screening guidelines recommending at what age screening should occur, and type and frequency of screening tests or procedures for specific cancers. To learn more about which cancers have a screening test and the types

of test procedures used, please see the ACS guidelines for the early detection of cancer (https://www.cancer.org/healthy/find-cancer-early/cancer-screening-guidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer.html) page (6) or CDC-Screening Tests (https://www.cdc.gov/cancer/dcpc/prevention/screening.htm) (7) page. If you have questions about whether you should be screened and when, please contact your health care provider.

The Minnesota Department of Health's Sage Cancer Screening (https://www.health.state.mn.us/diseases/cancer/sage/index.html) provides free screening for breast, cervical, and colorectal cancers at participating locations across Minnesota. To determine if you are eligible for the programs' free cancer screening based on your age, insurance and income, please go to Sage Cancer Screenings Covered Services and Eligibility (https://www.health.state.mn.us/diseases/cancer/sage/services/index.html).

Statistics Snapshot-Colorectal Cancer



Colorectal Cancer

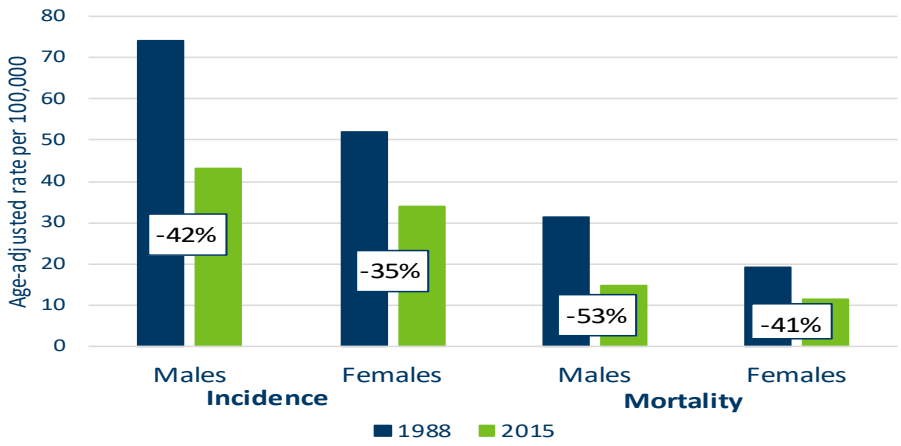
Colon and rectum (colorectal) cancer is the third most common malignant cancer worldwide and the second leading cause of cancer deaths in the United States (8). In Minnesota, colorectal cancer is the third most common cancer diagnosed and the third most common cause of cancer deaths in both males and females. Colorectal cancer usually develops slowly over the course of several years. It begins as a growth called a polyp inside the colon or rectum (9). Research has shown that screening procedures that surgically remove precancerous polyps can prevent colorectal cancer. Early detection and treatment of colorectal cancers can also reduce mortality from colorectal cancer (10).

Changes in colorectal cancer occurrence between 1988 and 2015 for males and females

The chart below displays the dramatic declines in colorectal cancer incidence and mortality between 1988 and 2015.

- From 1988 to 2015, the number of new colorectal cancers diagnosed increased slightly from 1,253 to 1,262 among males and decreased from 1,234 to 1,136 among females (Appendix A). Rates of new colorectal cancer diagnoses in 2015 were 42 percent lower in males and 35 percent lower in females than the corresponding rates in 1988.
- During this time the number of colorectal cancer deaths decreased 17 percent in males and 14 percent in females, from 507 to 421 deaths in males and from 482 to 415 in females (Appendix A). The decrease in the mortality rates of colorectal cancer for males and females between 1988 and 2015 was substantial. The rates were 53 percent lower in males and 41 percent lower in females than the corresponding mortality rates in 1988.
- Males have higher colorectal cancer incidence and mortality than females. Some possible reasons for these rate differences include differences in diet, cigarette smoking, colorectal cancer screening rates, and sex hormones (11).

Percent change in incidence and mortality for colorectal cancer, 1988-2015

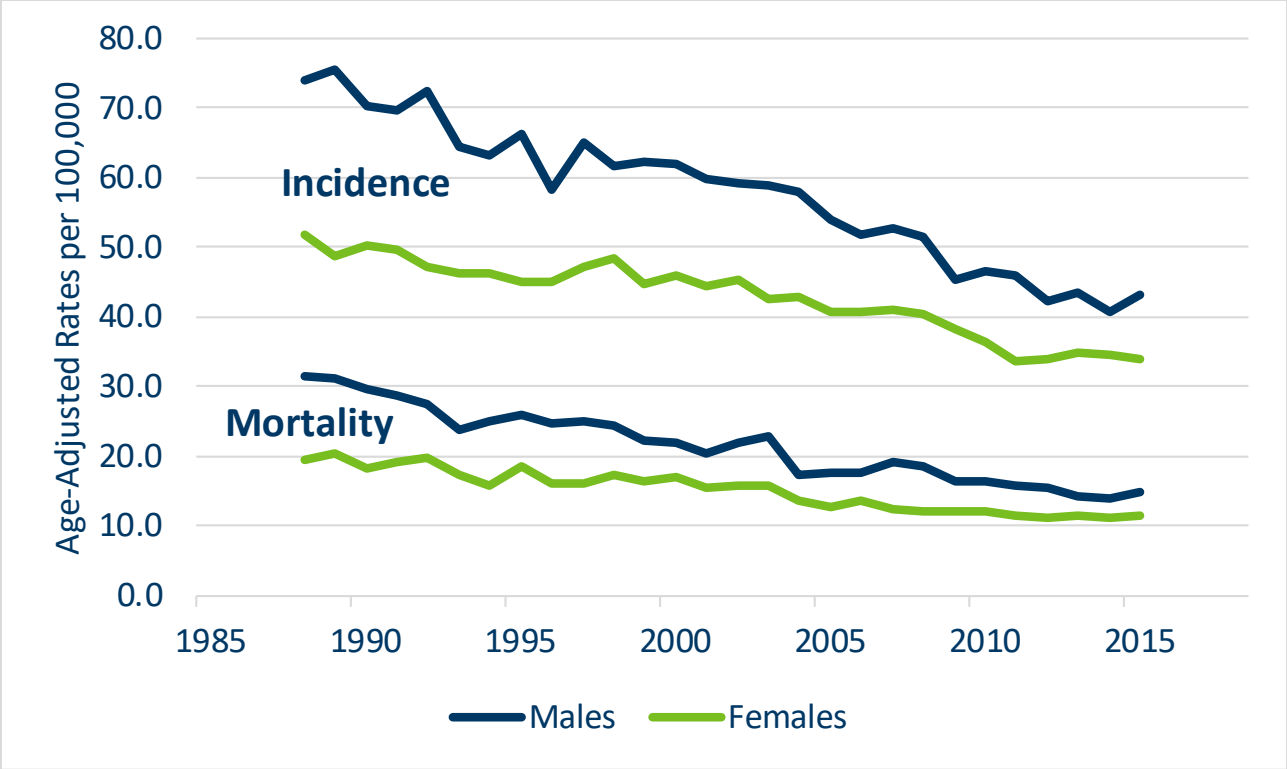


Trends in colorectal cancer incidence and mortality rates, 1988-2015

Rates of new diagnoses and deaths from colorectal cancers were consistently higher among males than females, but rates have decreased substantially for both sexes over the past 28 years.

- Between 1988 and 2015, the incidence rate of colorectal cancer in Minnesota has fluctuated, but there was a net decrease in the rates for both males and females. In the last ten years colorectal cancer incidence rates decreased by 2.7 percent per year for males and by 2.4 percent per year for females.
- Since 1988, colorectal cancer mortality rates for males and females in Minnesota have declined. In the last ten years colorectal cancer mortality rates decreased by 3.2 percent per year for males and by 1.9 percent per year for females.

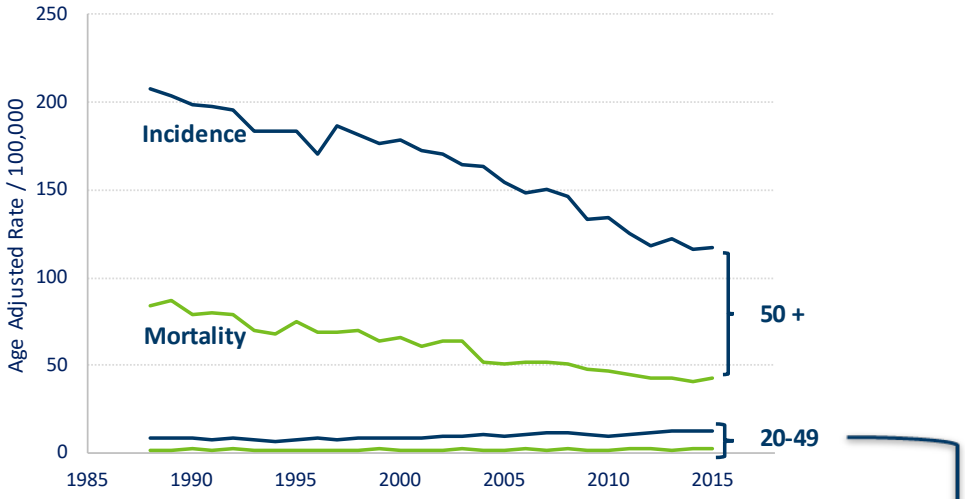
Colorectal cancer incidence and mortality rates, 1988-2015



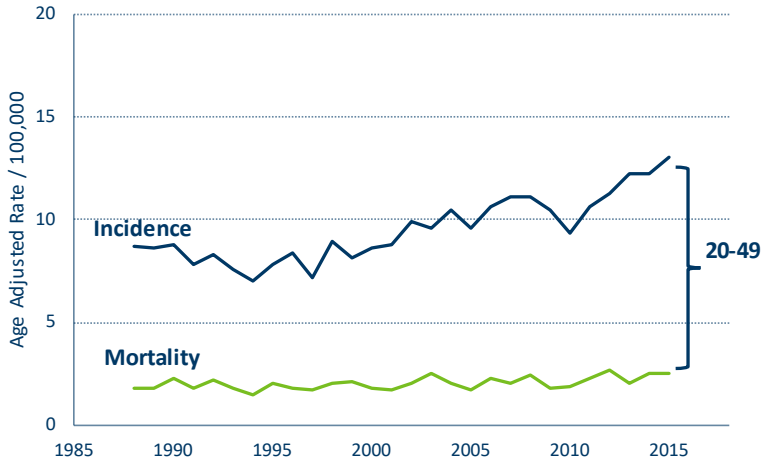
Trends in colorectal cancer incidence and mortality rates by age groups, 1988-2015

- For Minnesotans age 50 or more years, incidence and mortality has decreased over the last ten years 3.1 percent per year for incidence and 2.8 percent per year for mortality.
- By contrast, for people between ages 20 and 49 years, incidence of colorectal cancers has increased 2.0 percent per year over the last ten years. Mortality for these individuals remained stable between 1988 and 2015.
- U.S. trends in colorectal cancer incidence and mortality show similar patterns by age group (1). The exact reasons are unknown, but possible explanations include increases in the prevalence of diabetes and obesity, and other factors that increase the risk of developing colorectal cancer (12).

Colorectal cancer incidence and mortality for ages 20-49 and 50+



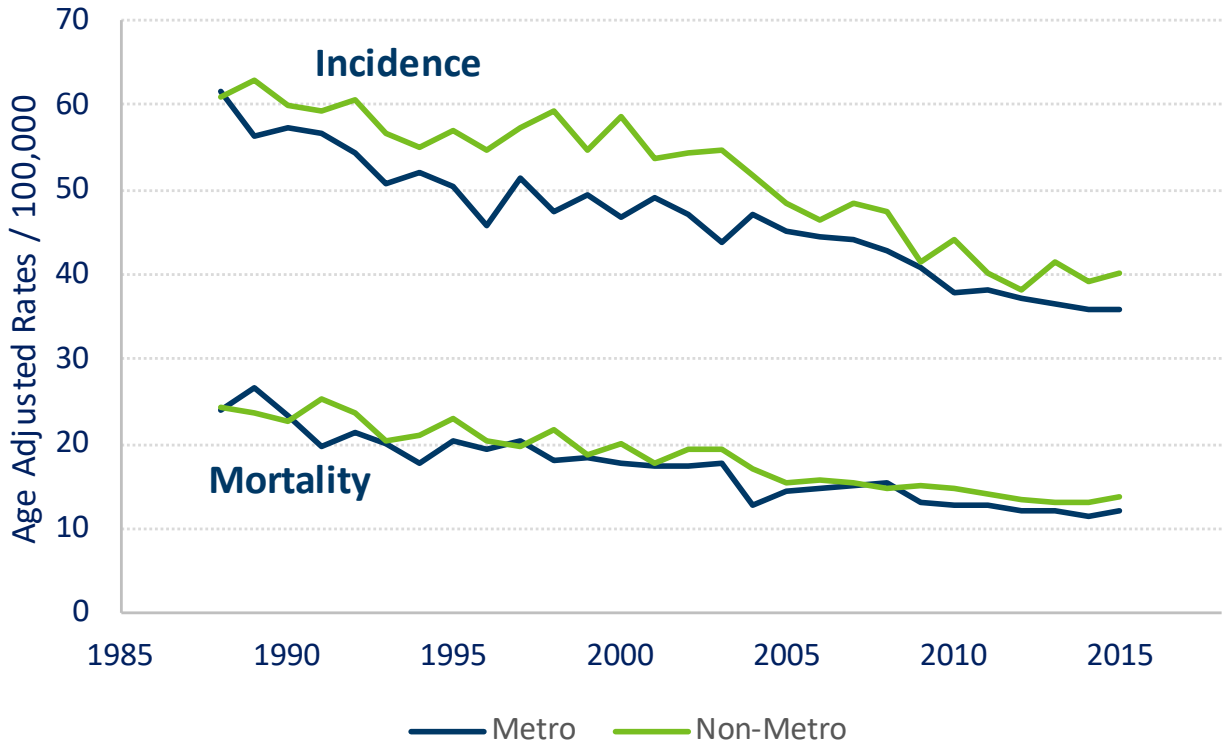
Colorectal cancer incidence and mortality for ages 20-49



Trends in colorectal cancer incidence rates by region, 1988-2015

Colorectal cancer incidence and mortality rates differ across Minnesota regions.

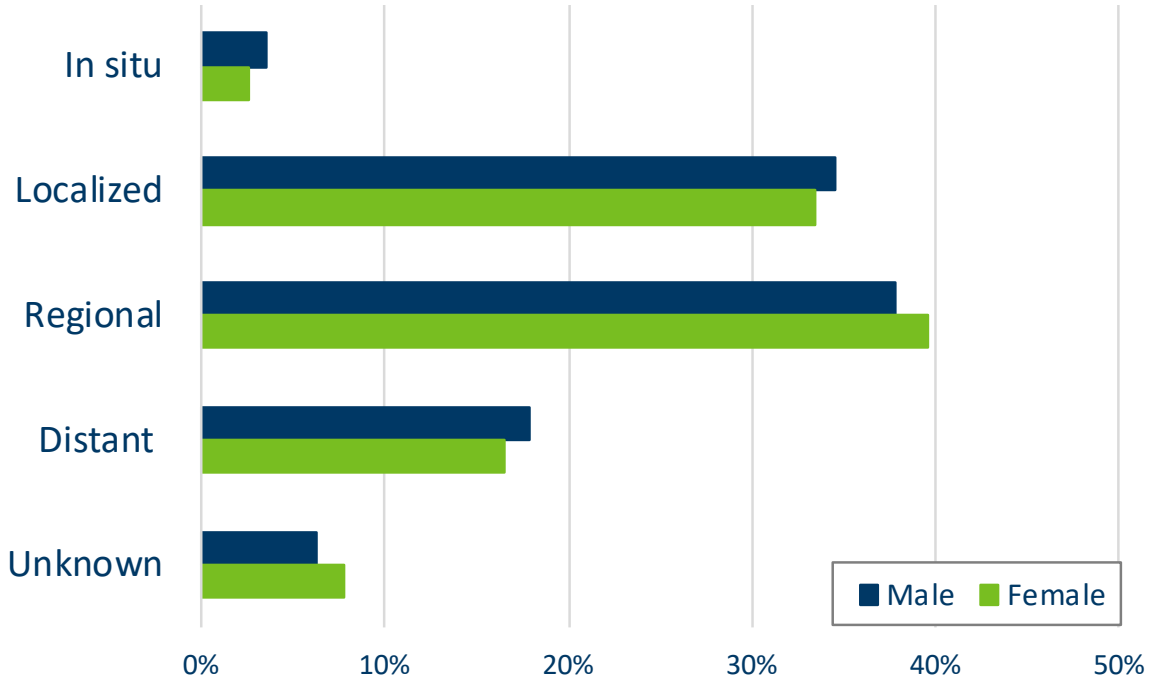
- Since 1988, the rates for colorectal cancer incidence and mortality have been higher in the 80 Minnesota counties outside of the 7-County Metro area. Based on average rates for the most recent ten years of MCRS data (2006-2015), the average incidence and mortality for colorectal cancer was 9 percent higher in the 80 counties outside of the 7-County Metro area. The average incidence for the years 2006-2015 was 42.5 per 100,000 for the 80 non-Metro counties and 39.0 per 100,000 for the 7-County Metro. The average mortality was 14.2 per 100,000 for the 80 non-Metro counties and 13.0 per 100,000 for the 7-County Metro.
- Rates of colorectal cancer incidence and mortality have decreased in both regions. In the 7-County Metro, incidence has decreased by 2.7 percent per year and mortality by 3.0 percent per year over the last 10 years. In the remaining 80 counties, incidence has decreased 2.3 percent per year and mortality by 2.1 percent per year.
- Urban-rural health disparities are a long-standing public health problem in Minnesota. Differences in colorectal cancer rates likely stem from a combination of low colorectal cancer screening in rural areas (13), the availability of physicians in urban vs. rural areas (14), and factors such as income and education that contribute to barriers to access to care (15).



Percent of colorectal cancer cases by stage at diagnosis

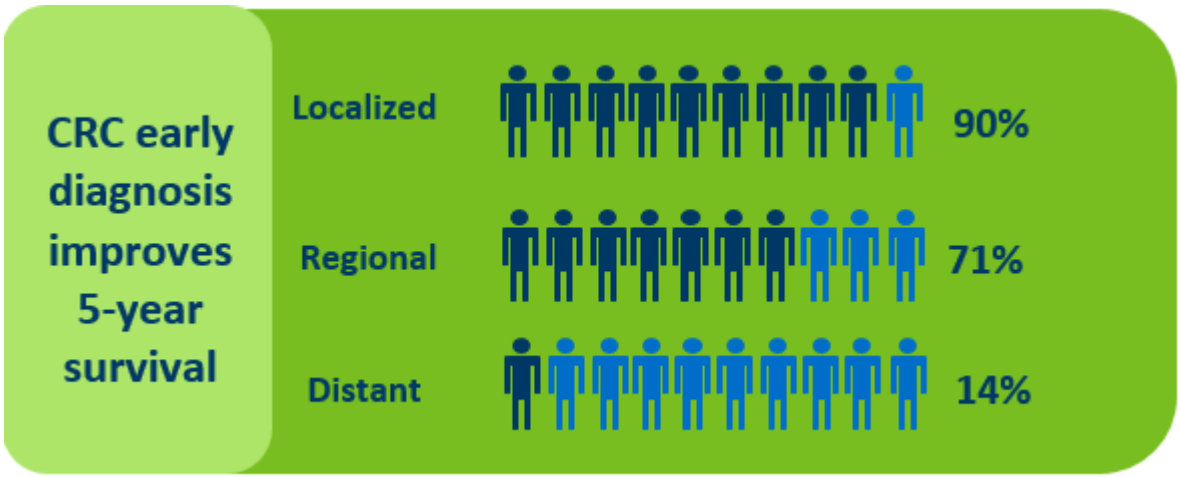
- For males and females, a greater percent of colorectal cancers were diagnosed at an advanced stage (regional or distant) than at an early stage (in situ or localized).
- Overall and by sex, the chance of surviving colorectal cancer for at least 5 years is much higher when cancers are identified and treated in early stage (in situ or localized).

Percent stage at diagnosis for males and females, 2011-2015



Stage	Males Count	Males %	Females Count	Females %
In situ	368	3.6%	234	2.6%
Localized	3,535	34.5%	2,998	33.5%
Regional	3,876	37.8%	3,548	39.6%
Distant	1,833	17.9%	1,481	16.5%
Unknown	644	6.3%	698	7.8%

Overall colorectal cancer survival by stage at diagnosis, 2011-2015

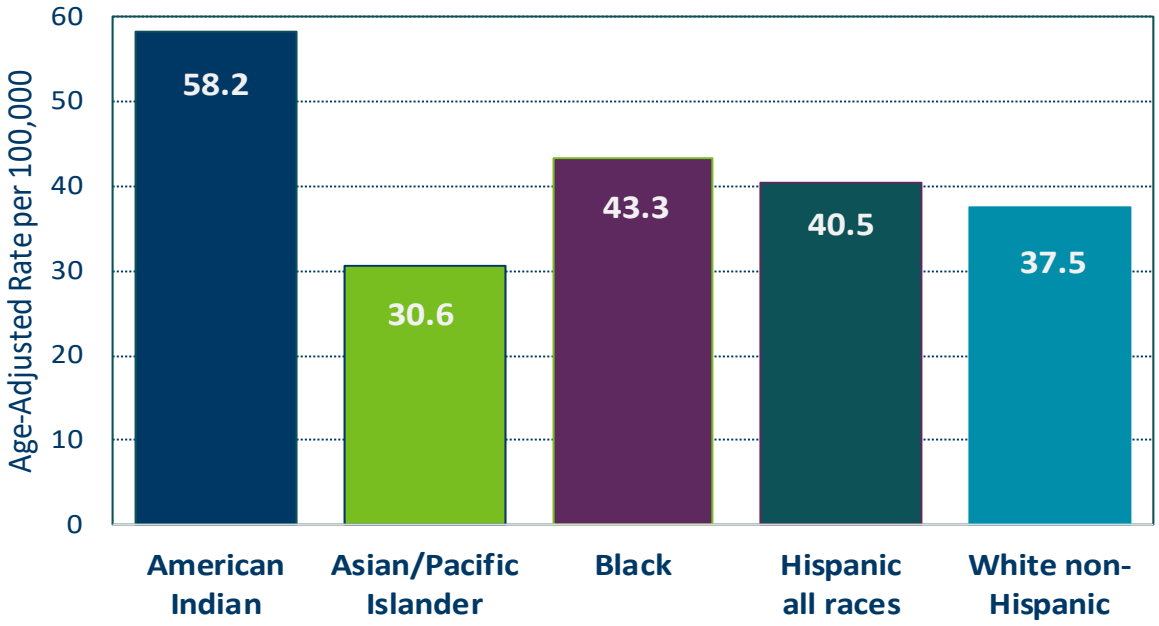


Colorectal cancer incidence by race and ethnicity

The chart and table below show the high burden of colorectal cancer incidence in the American Indian population of Minnesota.

- Overall and by sex, American Indians had the highest colorectal cancer incidence rate and Asian and Pacific Islander Minnesotans had the lowest incidence rate.
- Among males, colorectal cancer incidence rates were very similar for those who were black and Hispanic of all races. The 2011-2015 incidence rate for American Indians was nearly 2 times the rate for Asian and Pacific Islander and 1.6 times the rate for whites.
- Among females, the rates were similar for Hispanics of all races and black Minnesotans, and both groups had higher rates than whites. The incidence rate for American Indians was 1.7 times the rate for Asian and Pacific Islanders and 1.5 times the rate for whites.

Colorectal cancer incidence rates by race/ethnicity, 2011-2015



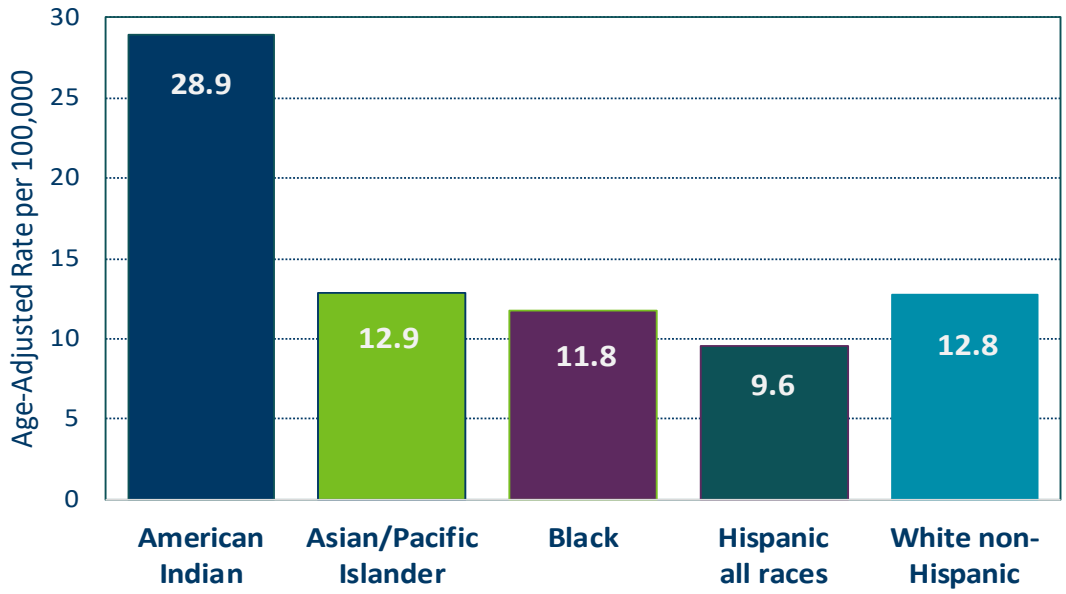
Race/ethnicity	Total Rate	Count	Male Rate	Count	Female Rate	Count
American Indian	58.2	143	67.0	82	50.1	61
Asian/Pacific Islander	30.6	223	30.5	104	30.3	119
Black	43.3	374	44.7	188	42.2	186
Hispanic all races	40.5	201	36.4	92	44.0	109
White non-Hispanic	37.5	10,579	42.4	5,491	33.0	5,088
All Races Combined	38.3	11,669	43.0	6,038	34.1	5,631

Colorectal cancer mortality by race and ethnicity

The chart and table below show the high burden of colorectal cancer mortality in the American Indian population of Minnesota.

- Overall and by sex, American Indians had the highest mortality rates for colorectal cancer, followed by whites. Hispanics had the lowest rates.
- Among males only, the age-adjusted mortality rate for American Indians ranged between 2.5 and 4.0 times the mortality rates for males of other racial and ethnic groups. Among females only, the mortality rate for American Indians ranged between 1.6 and 2.3 times the mortality rates for females of the other racial and ethnic groups in Minnesota.
- Overall, the HP2020 goal for colorectal cancer mortality has not been met for American Indians. By sex, this goal has not been met for American Indian and white males and American Indian females.

Colorectal cancer mortality rates by race/ethnicity, 2011-2015



Race	Total Rate	Count	Male Rate	Count	Female Rate	Count
American Indian	28.9	56	36.9	33	22.4	23
Asian/Pacific Islander	12.9	87	10.7	34	14.1	53
Black	11.8	94	12.3	51	11.0	43
Hispanic all races	9.6	38	9.2	18	9.8	20
White non-Hispanic	12.8	3,748	14.8	1,880	11.1	1,868
All Races Combined	12.8	4,008	14.8	2,008	11.2	2,000

Healthy People 2020 colorectal cancer mortality goal: 14.5 deaths/100,000

Risk factors and screening

Colorectal cancer symptoms

Symptoms vary from person to person (16). They can include:

- A change in bowel habits, including diarrhea, constipation, or a change in stool consistency that lasts longer than 4 weeks
- Rectal bleeding or blood in your stool, including black, tarry stools
- Persistent abdominal discomfort such as cramps, gas, or pain
- A feeling that your bowel doesn't empty completely
- Weakness or fatigue
- Unexplained weight loss

Colorectal cancer risk factors

- As we age, our risk of colorectal cancer increases because of accumulated errors in replication and exposure to mutagens over our lifetime.
- Lifestyle behaviors can increase the risk of colorectal cancer. These include alcohol consumption, poor diet, physical inactivity, and smoking.
- Various conditions such as diabetes and obesity also increase the risk of colorectal cancer.
- Certain genetic diseases predispose people to higher rates of colorectal cancer, including: ulcerative colitis, Crohn's, Familial Adenomatous Polyposis (FAP), or Lynch syndrome.
- Your risk of colorectal cancer also increase if a family member has had colon cancer (17).

Ways to prevent or lower your risk of colorectal cancer

- According to the guidelines from the U.S. Preventive Services Task Force (USPSTF), men and women of average risk (those without genetic risk factors or a family history of colorectal cancer) should be screened beginning at age 50 through age 75 (18). The American Cancer Society has similar recommendations for screening (19).
- Based on new recommendations from the American college of Gastroenterology, African Americans should begin screening at age 45 due to their higher national incidence rate of colorectal cancer (20).
- Screening should begin earlier based on a doctor's recommendation for those at increased risk, such as family or a personal history of colorectal cancer, or a known family history of a hereditary syndrome such as Familial Adenomatous Polyposis (FAP), or Lynch syndrome.
- Screening can be performed in a variety of ways including:
  - A colonoscopy every 10 years
  - A flexible sigmoidoscopy or CT colonography every 5 years
  - Stool DNA test every 1-3 years
  - Fecal occult blood test or fecal immunochemical test every year.

MDH Sage Scopes Screening Program

For eligible men and women who meet age, insurance and income criteria, the MDH Sage Scopes Cancer Screening Program offers free colonoscopies. For more information, please see Sage-Scopes Colorectal Cancer Screening Program (https://www.health.state.mn.us/diseases/cancer/scopes/index.html) for screening guidelines.

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All cancers combined

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Colorectal cancer

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Understanding Cancer Statistics

This report describes the occurrence of invasive cancers in Minnesota for the following sites: all cancer sites combined and colon and rectum combined (colorectal cancers). Colorectal cancer has established public health cancer prevention and intervention programs ongoing in Minnesota.

For an overview of work cancer registries perform in support of cancer prevention and control programs, please see the North American Association of Central Cancer Registries (NAACCR) YouTube channel (https://youtu.be/VWtKsQvFKdA).

Counts versus rates provide important but different information about the cancer burden in Minnesota.

- **Counts** of people with cancer are needed in planning and evaluating programs and services for people newly diagnosed with a cancer. For example, a count of particular cancer will estimate the number of Minnesotans with that cancer who need services for treatment and follow-up. The larger the population, the larger the number of cancers diagnosed in that population. In Minnesota, people who are of white race make up about 84 percent of the total population. As such, counts of cancers for whites are often greater than the counts of cancers for Minnesotans who are of non-white racial and ethnic groups.
- **Rates** of cancer are useful in establishing priorities, developing and evaluating cancer control and intervention programs, and identifying the need for health services and epidemiologic research studies. For example, differences in the chance of a cancer diagnosis between one or more groups in a population can occur because of disparities in access to health care and screening services. Disparities can also occur because of differences in exposure to such factors as cigarette smoking, the routine use of sunscreen, and hepatitis B vaccination that can increase or decrease the risk of developing cancer. Epidemiologists and other researchers analyze cancer registry data to understand the reasons for differences in cancer occurrence between populations. The results of such analyses can inform next steps in cancer prevention and control measures to protect the public's health. Although people of color and American Indians represent 16 percent of the total population in Minnesota, cancer rates are often higher among people of color and American Indians compared with Minnesota residents who are of white race. There are a number of ongoing initiatives and programs throughout the state to eliminate racial and ethnic cancer-related disparities.

Cancer Incidence is the number of invasive cancers newly diagnosed in a defined population at risk of developing cancer during a specified year or group of years. An invasive cancer is one that has spread beyond the site where the cancer cells first developed. Incidence statistics for all cancer sites combined also includes in situ bladder cancers. An in situ cancer has not gained access to blood vessels. For this reason, in situ cancers typically do not spread to distant sites in the body. The incidence statistics presented in this report are based on MCRS data extracted from a dynamic database in April 2018. Because the MCRS database constantly changes, statistics in this report will differ slightly from statistics based on MCRS data extracted on a different date. (See the Resource Section for details on statistical methods and cancers included in this report).

Cancer incidence rate =

$$\left(\frac{Number\ of\ new\ cancers\ diagnosed\ in\ a\ defined\ population\ in\ specified\ years}{Number\ of\ people\ in\ the\ defined\ population\ in\ specified\ years}\right) \text{ x } 100{,}000$$

For example, the unadjusted incidence rate for colorectal cancers among Minnesota males in 2014 was 44.1 per 100,000. This statistic means that in 2014 there were nearly 45 new colorectal cancers diagnosed for every 100,000 males living in Minnesota on July 1, 2014. The defined population is males living in Minnesota on July 1, 2014. The size of the population was estimated using data from the U.S. Census Bureau.

Population refers to the people living in a geographic region with a defined boundary such as a county or state during a specified year or group of years. Demographic characteristics including age and sex can refine the definition for a population. The size of a population is estimated using census data developed by the U.S. Census Bureau in collaboration with the National Center for Health Statistics. Population data are available in the National Cancer Institute's SEER*Stat analytic software. For more information on population, please visit the National Cancer Institute (NIH) – U.S. Population Data – 1969-2017 (https://seer.cancer.gov/popdata/) page.

Cancer mortality is the number of deaths from cancer as the underlying cause of death in Minnesota residents in a specified year or group of years. The mortality statistics in this report were developed using data from the Minnesota Department of Health's Center for Health Statistics (https://www.health.state.mn.us/data/mchs/genstats/index.html).

Cancer mortality rate =

$$\left(\frac{Number\ of\ cancer\ deaths\ diagnosed\ in\ a\ defined\ population\ in\ specified\ years}{Number\ of\ people\ in\ the\ defined\ population\ in\ specified\ years}\right) \text{ x } 100{,}000$$

For example, the unadjusted mortality rate for female colorectal cancer in 2015 was 11.4 per 100,000. This statistic means that in 2015 there were nearly 12 Minnesota females who died of colorectal cancer for every 100,000 female who were residents of Minnesota on July 1, 2015. The defined population is females living in Minnesota on July 1, 2015. The size of the population was estimated using data from the U.S. Census Bureau.

Age-specific rates are cancer incidence or mortality rates calculated using the methods described above for separate age-groups. Age groups in this report are: 0-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85+.

Age-specific rates show how the burden of a given cancer differs by age in a defined population of Minnesotans. Because cancer is typically a disease of older people, age-specific cancer incidence and mortality rates tend to increase with older age.

Age-adjusted rate is a weighted average of age-specific rates for a given population and year or group of years. The weights are the proportion of people in the corresponding age groups of a standard population. Age-adjusted rates are used for comparing rates for different populations (for example, Minnesota versus the US in 2013) or for comparing rates across different years (for example, Minnesota in 1988 versus Minnesota in 2015).

For an explanation of the method to calculate age-adjusted rates, please visit NIH SEER Stat Tutorials: Calculating Age- adjusted Rates (https://seer.cancer.gov/seerstat/tutorials/aarates/definition.html) page.

In this report, the standard population is the 2000 US Census.

The risk of cancer is dramatically higher in older (age 50 or more years) than younger people (less than age 50 years). This fact complicates comparing cancer rates over time as well as between different populations. Without accounting for differences in age, populations with a greater proportion of older people will have higher cancer rates than populations with a smaller proportion of older people. If we want compare rates to find out which population or time period has a higher cancer rate, we need to adjust for differences in age distributions. In this report, we use the direct method of age-standardization. This approach levels out the differences in age, so we can make fair comparisons of cancer rates.

Rates by race and ethnicity measures the burden of cancer in racial and ethnic groups in a population. Racial and ethnic groups for this report include American Indian, Asian/Pacific Islander, black, Hispanic (all races), and white (non-Hispanic). This classification of race and ethnicity is based on standards from the Office of Budget and Management (OMB) and the National Cancer Institute (NCI).

In this report, we will refer to the white (non-Hispanic) population as white.

Examining rates for different racial and ethnic groups in Minnesota can show if there is a disproportionate burden of cancer incidence or mortality in Minnesota's populations of color and American Indians.

Cancer stage describes how far the cancer has spread in the body when the cancer was first diagnosed. The stage of a cancer at diagnosis is often related to the chances of surviving from that cancer over the long-term. There are several different ways to measure stage. This analysis uses NCI's summary staging system that classifies cancer stage for solid tumors as *in situ*, localized, regional, and distant.

- *In situ*: the earliest stage of cancer development when the tumor has not spread into the organ where they first started growing.
- Localized: the tumor is confined to the tissue or organ where the cancer first began and has not spread to nearby lymph nodes.
- Regional: the tumor has spread outside of the organ where they started to nearby lymph nodes, surrounding tissues, or organs close to where the cancer first began.
- Distant: most advanced stage of tumor development when the tumor has spread to lymph nodes, tissues and organs away from where the cancer first developed.
- Unknown: a tumor is unstaged when there is not enough information recorded in the medical record to determine the spread of the tumor at the time of diagnosis.

For screen-able cancers, incidence rates by cancer stage can show where increased public health intervention is needed to promote screening and early diagnosis of a cancer.

For detailed information on registry methods, legislative authority, data protection, glossary, statistical methods, and other topics, please visit the links listed in the Resource Section.

Resource Section

Data sources

Cancer incidence data

Cancer incidence data for this report were drawn from the MCRS database on April 2018. The database contains information on nearly all microscopically confirmed malignant and in site cancers diagnosed in Minnesota residents between 1988 and 2015. After a rule change, both clinical and microscopically confirmed cancers were reported to the state's cancer registry, starting in 2012. Cancers excluded from reporting include the most common forms of skin cancer (basal and squamous cell carcinomas) and in situ carcinomas of the cervix. These exclusions are consistent with guidelines for cancer registration practice in the U.S. (See Registry Methods and Standards below.) For detailed information about cancer reporting in Minnesota, cancer statistics and reports, legislative authority, and archived reports and publications, please visit Minnesota Cancer Reporting System (https://www.health.state.mn.us/data/mcrs/index.html).

Cancer mortality data

Gathering data on Minnesotans with cancer from death certificates is necessary to completely describe the cancer burden, as well as to evaluate the progress made in treating and controlling cancer in Minnesota. Mortality data are obtained from electronic death certificates on Minnesota residents. Only the underlying cause of death is used in calculating cancer mortality rates. To learn more about the Office of Vital Records and death certificates, in particular, please visit Minnesota Center for Health Statistics, Office of Vital Records (https://www.health.state.mn.us/people/vitalrecords/about.html).

Population data

The NCI's website contains population data used in generating statistics for this report. The U.S. Census Bureau develops annual population estimates. Census population estimation methods and the population estimates used in the calculations. See the National Cancer Institute (NCI) – U.S. Population Data – 1969-2017 (https://seer.cancer.gov/popdata/) page for more information.

Methods for data analyses

Analytic software

Incidence and mortality counts and age adjusted rates for this report were generated using NCI's SEER*Stat software. Trend statistics and average annual percent change estimates were generated using NCI's JoinPoint software. Percent change in the number of cancers and incidence or mortality rates were calculated to describe the change in cancer occurrence between 1988 and 2015. The year 1988 was the reference year in calculating percent change. Rate ratios were calculated to identify and describe excess burden of cancer incidence or mortality by race and ethnicity. To calculate these ratios, the rate for the subpopulation with the highest rate was divided by the rates for the other racial and ethnic subpopulations to obtain a range of rate ratio estimates.

Defining cancer statistics

For more information about statistics used to assess the impact of cancer in the general population, go to NCI Defining Cancer Statistics page (https://seer.cancer.gov/statistics/types.html).

Age-adjusted rate

To learn what an age-adjusted rate is and how it is calculated, please see the NCI Tutorial to Calculate Age-Adjusted Rates (https://seer.cancer.gov/seerstat/tutorials/aarates/definition.html).

Unstable rate

An unstable rate is defined as one with a relative standard error (100 x SE/Rate) > 30%. If a rate was unstable only counts were included in a table. Unstable rates in the tables are denoted with "N/A".

Standard population

To learn more about the 2000 U.S. standard population used in calculating age-adjusted rates, go to NCI-2000 US Standard Population (https://seer.cancer.gov/stdpopulations/single_age.html).

Minnesota geographic divisions

The State Community Health Services Advisory Committee (SCHSAC) advises the health commissioner and provides guidance on the development, maintenance, financing, and evaluation of community health services in Minnesota. SCHSAC recommendations influence public health policy, guidelines, and practice throughout Minnesota. SCHSAC regions represent Minnesota's community health boards, whose representatives are members of SCHSAC. For more information about SCHSAC regions, go to State Community Health Services Advisory Committee (SCHSAC) (https://www.health.state.mn.us/communities/practice/schsac/index.html).

Collecting and processing cancer incidence and mortality data

MCRS authority and data protection

For information on the history, statutory authority, and objectives of the Minnesota Department of Health's statewide cancer registry please visit Legislative Authority for MCRS (https://www.health.state.mn.us/communities/practice/schsac/index.html).

For information on the Minnesota Government Data Practices Act please visit Minnesota Government Data Privacy Act (https://www.health.state.mn.us/communities/practice/resources/chsadmin/data-mgdpa.html).

Registry methods and standards

The North American Association of Central Cancer Registries (NAACCR) provides the data dictionary and standards governing data collection, coding, processing used in member central cancer registries to develop high quality cancer data needed to address the cancer burden in North America, including Minnesota. For more information about NAACCR please visit the section "Central Registry Standards" on the North American Association of Central Cancer Registries (NAACCR) (https://www.naaccr.org/) page.

Definitions for cancer incidence data

A diagnosis of cancer includes identifying and describing where in the body (site) the cancer is present, and the cell type (histology) of the tumor. A part of cancer registration includes assigning codes to cancer site and histology for each cancer reported to the MCRS. The World Health Organization maintains the rules for coding cancer site and histology, which are documented in the International Classification of Diseases for Oncology (ICD-O). The current version of the ICD-O rules is ICD-O/WHO 2008. To learn more about the ICD-O, go to International Classification of Diseases for Oncology (ICD-O) (http://codes.iarc.fr/home).

To analyze cancer data, ICD-O-3 site and histology codes are grouped together using the National Cancer Institute's SEER Program conventions and standards. To learn more about SEER's Site Recodes, see the SEER Site Recode page (https://seer.cancer.gov/siterecode/) and to read more about the Site Recode ICD-O-3/WHO 2008 Definition (https://seer.cancer.gov/siterecode/icdo3_dwhoheme/index.html).

Definitions for cancer mortality data

Causes of death are coded using the World Health Organization's International Classification of Diseases (ICD). The current version of the ICD is ICD-10, 2016, which can be viewed at ICD-10 Version 2016 (https://icd.who.int/browse10/2016/en).

The NCI's SEER program groups ICD causes of death codes together to analyze cancer mortality data. The site groupings account for changes in coding over time to facilitate reporting of long term trends. To learn more about SEER's Cause of Death Recode, please see the SEER Cause of Death Recode (https://seer.cancer.gov/codrecode/) page.

GIS analysis for county level data

The classifications in the county level maps were calculated using Jenks natural breaks classification method. If a county level rate was unstable, hash marks identified that county in the map. Unstable rates displayed on county level maps should be interpreted with caution. Unstable rates in the tables in Appendix B are denoted with "N/A". Maps for melanoma mortality and cervical cancer incidence and mortality are not presented because of a large number of counties with unstable rates.

Glossary of Terms

To look up unfamiliar terms please visit NCI Glossary of Statistical Terms (https://seer.cancer.gov/cgi-bin/glossary/glossary.pl) page.

Health Impacts of Cancer

Know your chances

NIH-Know Your Chances (https://knowyourchances.cancer.gov/) is an interactive tool to learn about how age, sex, and race can influence a person's chance of developing cancer, various other chronic diseases, and injury.

Healthy People 2020

To learn more about the CDC's Healthy People 2020 objectives, go to CDC Healthy People 2020 (https://www.cdc.gov/nchs/healthy_people/hp2020.htm).

Other sources of cancer statistics

For MCRS cancer reports go to Data - MCRS Cancer Statistics and Reports (https://www.health.state.mn.us/data/mcrs/data/index.html). Or the Minnesota Public Health Data Access portal (https://data.web.health.state.mn.us/web/mndata/).

For statistics on cancers in the US, please see the National Cancer Institute -Cancer Statistics (https://seer.cancer.gov/statistics/), National Program of Cancer Registries (https://www.cdc.gov/cancer/npcr/index.htm) or Centers for Disease and Prevention online database-WONDER (https://wonder.cdc.gov/) for more information.

Programs

Comprehensive Cancer Control Program

The Comprehensive Cancer Control Program (https://www.health.state.mn.us/diseases/cancer/compcancer/index.html) at the Minnesota Department of Health is a CDC funded initiative to strengthen efforts across Minnesota to decrease the impacts of cancer. To achieve this objective, program staff collaborated with the Minnesota Cancer Alliance (below) to develop the *Cancer Plan Minnesota: A Framework for Action*.

Minnesota Cancer Alliance

The Minnesota Cancer Alliance is a coalition of more than 100 organizations from diverse backgrounds and disciplines dedicated toward reducing the burden of cancer in Minnesota. Members are actively working to achieve the objectives of the *Cancer Plan Minnesota 2025*. For more information, go to Minnesota Cancer Alliance (https://mncanceralliance.org/).

Sage Screening Programs

The Minnesota Department of Health's Sage Screening Programs provide free screening for breast, cervical, and colorectal cancers at participating locations across Minnesota. The program has a wide network of partners working together to reduce the burden of cancer by providing access to and promoting breast, cervical, and colorectal cancer screening services for Minnesota's uninsured and underinsured populations. For more information, go to MDH Sage Screening Programs (https://www.health.state.mn.us/diseases/cancer/sage/about/index.html).

Healthy Minnesota Partnership

The Healthy Minnesota Partnership is a collaboration between community partners and the Minnesota Department of Health to improve the health and quality of life for individuals, families and communities in the state. The Healthy Minnesota 2020 Framework identifies and acts on strategic opportunities to improve health and well-being for all people in Minnesota. The most recent progress report was produced as a collaboration between the Minnesota Department of Health and the Healthy Minnesota Partnership. To access the report, go to Healthy Minnesota 2020 Update (https://www.health.state.mn.us/communities/practice/healthymnpartnership/docs/annualreport2017.pdf).

Center for Health Equity

The Center for Health Equity (CHE) was created in 2013 to advance health equity as a practice or approach within the Minnesota Department of Health and across the state. Under CHE's leadership, Minnesota's approach addresses health disparities as part of a broad spectrum of public investments in housing, transportation, education, economic opportunity and criminal justice. CHE also carries out specific initiatives and projects, including state funding available to Tribal Nations to support Eliminating Health Disparities Initiative (EHDI) activities (Minnesota Statute 145.928, subdivision 10). EHDI funding is for various activities in health areas including decreasing morbidity and mortality rates from breast and cervical cancer, diabetes, HIV/AIDS and other health conditions. For more information, go to MDH Center for Health Equity (https://www.health.state.mn.us/communities/equity/about/index.html).

Statewide Health Improvement Partnership

SHIP works to create healthier communities across Minnesota by expanding opportunities for active living, healthy eating and tobacco-free living. At its core, SHIP is a locally driven effort, with community partnerships formed to create better health together across Minnesota. Communities choose strategies that are based on the latest science and focused on making long-term, sustainable changes in schools and child care facilities, communities, workplaces and health care settings. SHIP has been instrumental in helping Minnesota keep obesity rates relatively flat, and reducing commercial tobacco use and secondhand smoke exposure. These factors contribute to chronic diseases, rising health care costs, disability and death. For more information about SHIP, go to Statewide Health Improvement Partnership (https://www.health.state.mn.us/communities/ship/).

Appendices

A. Trend Data

All cancers sites combined

Year	Males Incidence Rate	Males Incidence Count	Females Incidence Rate	Females Incidence Count	Males Mortality Rate	Males Mortality Count	Females Mortality Rate	Females Mortality Count
1988	528.8	9,147	397.6	8,851	257.9	4,205	164.5	3,895
1989	532.9	9,329	381.1	8,576	254.1	4,219	159.7	3,789
1990	546.7	9,712	392.6	8,920	251.5	4,256	160.7	3,857
1991	590.2	10,692	390.5	8,974	255.0	4,362	163.7	4,014
1992	620.9	11,389	393.0	9,182	253.9	4,422	165.1	4,116
1993	568.0	10,653	386.6	9,145	244.1	4,317	160.8	4,087
1994	536.1	10,226	391.7	9,401	250.8	4,487	158.6	4,055
1995	543.4	10,489	392.3	9,553	245.3	4,463	161.7	4,209
1996	527.2	10,349	392.7	9,691	245.0	4,541	163.8	4,309
1997	546.1	10,837	399.6	10,008	241.8	4,556	155.9	4,178
1998	539.5	10,894	411.5	10,454	234.5	4,480	157.7	4,313
1999	552.6	11,375	410.3	10,551	233.7	4,572	155.7	4,296
2000	571.8	12,002	415.3	10,820	236.9	4,695	161.3	4,503
2001	571.6	12,209	420.6	11,097	228.0	4,610	152.7	4,297
2002	564.9	12,332	416.3	11,169	230.8	4,745	155.0	4,455
2003	549.1	12,233	407.0	11,061	223.8	4,701	155.5	4,482
2004	560.5	12,739	409.3	11,314	216.9	4,643	151.7	4,447
2005	548.0	12,763	406.7	11,402	203.9	4,464	146.0	4,359
2006	561.5	13,378	409.4	11,639	206.9	4,660	146.1	4,404
2007	574.0	14,061	423.2	12,279	208.2	4,813	141.1	4,355
2008	553.9	14,012	423.2	12,443	202.0	4,783	148.8	4,656
2009	529.2	13,769	424.8	12,678	204.6	4,979	143.6	4,591
2010	521.0	13,786	424.9	12,898	201.1	5,017	140.7	4,582
2011	524.1	14,296	429.1	13,235	193.4	4,957	136.0	4,511
2012	495.8	13,857	429.2	13,563	187.9	4,937	132.9	4,497
2013	483.0	13,902	423.7	13,558	184.4	4,992	134.8	4,611
2014	474.8	14,031	429.3	13,979	181.2	5,027	130.6	4,597
2015	501.9	15,104	446.8	14,743	186.7	5,352	136.9	4,890

Colorectal cancer

Year	Males Incidence Rate	Males Incidence Count	Females Incidence Rate	Females Incidence Count	Males Mortality Rate	Males Mortality Count	Females Mortality Rate	Females Mortality Count
1988	74.1	1,253	51.9	1,234	31.5	507	19.3	482
1989	75.4	1,292	48.8	1,179	31.1	515	20.4	517
1990	70.4	1,218	50.3	1,226	29.5	497	18.2	462
1991	69.7	1,229	49.6	1,219	28.8	482	19.1	495
1992	72.5	1,291	47.3	1,179	27.6	464	19.9	522
1993	64.3	1,175	46.3	1,174	23.7	416	17.4	473
1994	63.2	1,180	46.2	1,190	25.0	446	15.6	432
1995	66.2	1,245	45.0	1,179	25.8	470	18.4	517
1996	58.4	1,118	45.0	1,179	24.8	454	16.2	461
1997	65.0	1,250	47.2	1,259	25.1	466	16.2	461
1998	61.6	1,216	48.5	1,305	24.4	461	17.2	496
1999	62.4	1,255	44.7	1,222	22.2	425	16.5	475
2000	61.9	1,275	46.1	1,276	21.8	429	16.9	497
2001	59.9	1,262	44.4	1,237	20.5	410	15.3	458
2002	59.1	1,268	45.3	1,273	21.8	451	15.9	481
2003	58.9	1,292	42.5	1,213	22.8	473	15.9	487
2004	58.1	1,307	42.8	1,234	17.3	371	13.7	425
2005	54.1	1,247	40.6	1,194	17.7	383	12.7	408
2006	51.8	1,212	40.6	1,194	17.6	393	13.7	429
2007	52.7	1,280	40.9	1,248	19.0	444	12.4	411
2008	51.4	1,276	40.4	1,231	18.6	445	12.2	401
2009	45.2	1,156	38.1	1,180	16.5	404	12.1	408
2010	46.7	1,215	36.3	1,150	16.5	416	11.9	406
2011	45.8	1,226	33.5	1,075	15.9	415	11.4	395
2012	42.3	1,150	33.9	1,098	15.4	404	11.0	388
2013	43.5	1,227	35.0	1,168	14.2	383	11.4	407
2014	40.7	1,173	34.5	1,154	13.9	385	11.0	395
2015	43.2	1,262	33.9	1,136	14.8	421	11.4	415

Colorectal cancer by age group

Year	20-49 years Incidence Rate	20-49 years Incidence Count	50+ years Incidence Rate	50+ years Incidence Count	20-49 years Mortality Rate	20-49 years Mortality Count	50+ years Mortality Rate	50+ years Mortality Count
1988	8.7	135	208.0	2,351	1.8	27	84.4	962
1989	8.6	137	203.4	2,333	1.8	28	87.2	1,004
1990	8.8	149	198.6	2,295	2.3	39.0	78.9	920
1991	7.8	137	197.6	2,311	1.8	31	79.8	946
1992	8.3	150	195.8	2,318	2.2	39	78.8	947
1993	7.6	144	183.7	2,204	1.8	34	69.9	855
1994	7.0	136	183.3	2,232	1.5	30	68.2	847
1995	7.8	155	183.6	2,266	2.0	40	75.4	947
1996	8.4	174	170.5	2,122	1.8	38	68.8	877
1997	7.2	151	186.4	2,357	1.7	36	69.0	890
1998	8.9	190	181.7	2,329	2.0	42	69.7	915
1999	8.1	177	176.5	2,299	2.1	46	64.2	854
2000	8.6	191	178.4	2,357	1.8	39	65.7	887
2001	8.8	196	172.7	2,302	1.7	39	60.4	828
2002	9.9	223	170.0	2,318	2.0	45	63.7	887
2003	9.6	219	164.7	2,285	2.5	57	63.6	903
2004	10.5	239	163.0	2,301	2.0	44	51.6	751
2005	9.6	218	154.3	2,222	1.7	40	51.2	751
2006	10.6	239	148.0	2,164	2.3	51	51.5	770
2007	11.1	250	150.4	2,276	2.0	45	52.2	810
2008	11.1	246	146.3	2,261	2.4	54	50.5	792
2009	10.5	224	133.2	2,110	1.8	39	48.0	773
2010	9.3	204	134.1	2,160	1.9	41	47.2	781
2011	10.6	225	125.5	2,076	2.3	51	45.1	759
2012	11.3	236	118.5	2,008	2.7	56	42.5	736
2013	12.2	250	121.7	2,141	2.0	41	42.6	748
2014	12.2	245	115.9	2,077	2.5	50	40.8	730
2015	13.0	260	117.1	2,130	2.5	49	42.5	787

Colorectal cancer by region

Year	Metro Incidence Rate	Metro Incidence Count	Non-metro Incidence Rate	Non-metro Incidence Count	Metro Mortality Rate	Metro Mortality Count	Non-metro Mortality Rate	Non-metro Mortality Count
1988	61.6	1,074	60.9	1,413	23.8	410	24.2	579
1989	56.5	996	63.0	1,475	26.6	463	23.7	569
1990	57.5	1,033	59.9	1,411	23.3	417	22.5	542
1991	56.5	1,037	59.3	1,411	19.5	355	25.3	622
1992	54.2	1,015	60.6	1,455	21.4	398	23.8	588
1993	50.7	971	56.8	1,378	20.2	382	20.3	507
1994	52.1	1,015	54.9	1,355	17.9	346	20.9	532
1995	50.5	1,004	57.0	1,420	20.2	397	23.0	590
1996	45.9	929	54.6	1,368	19.3	387	20.2	528
1997	51.3	1,052	57.3	1,457	20.3	415	19.6	512
1998	47.5	1,005	59.2	1,516	18.2	379	21.8	578
1999	49.4	1,059	54.7	1,418	18.4	391	18.8	509
2000	46.8	1,023	58.5	1,528	17.7	379	20.0	547
2001	49.0	1,084	53.8	1,415	17.3	379	17.6	489
2002	47.2	1,079	54.4	1,462	17.4	393	19.2	539
2003	43.7	1,023	54.7	1,482	17.7	409	19.4	551
2004	47.3	1,126	51.8	1,415	12.9	305	16.9	491
2005	45.1	1,099	48.3	1,342	14.5	345	15.3	446
2006	44.5	1,102	46.5	1,304	14.6	360	15.7	462
2007	44.1	1,137	48.6	1,391	15.0	381	15.5	474
2008	42.7	1,119	47.5	1,388	15.4	398	14.8	448
2009	40.7	1,105	41.6	1,231	13.0	349	14.9	463
2010	37.9	1,042	44.2	1,323	12.8	358	14.7	464
2011	38.0	1,087	40.1	1,214	12.8	365	14.0	445
2012	37.0	1,086	38.2	1,162	12.2	360	13.5	432
2013	36.4	1,107	41.3	1,288	12.2	360	13.1	430
2014	35.8	1,104	39.1	1,223	11.5	351	13.0	429
2015	35.9	1,129	40.2	1,269	12.0	379	13.7	457

B. MCRS Publications and Reports

Over the past 28-years, Minnesota has promoted high quality research to provide better information for cancer control and to address public concerns and questions about cancer. The list below highlights how MCRS cancer data has been used in research and public health since the registry began in 1988 to address the burden of cancer in Minnesota.

- **Research**

  Approved academic researchers have used MCRS data to conduct studies into the causes of different types of adult and childhood cancers, as well as the safety of various cancer treatments, racial and ethnic disparities in cancer occurrence, health related quality of life, and cancer survivorship. Supplement 2 publications and data use (http://www.health.state.mn.us/data/mcrs/docs/2019biensupb.pdf) includes a bibliography of publications from these studies.

- **Resource allocation and health service planning**
  Health care organizations, facilities, clinicians, and local public health have used MCRS data to inform resource allocation and health services planning. MCRS data provide an important population-based perspective, because these analyses help answer questions about the completeness of local or regional cancer care coverage and services across Minnesota communities.

- **Inform cancer prevention and control programs**

  Public health professionals, legislators, coalitions, and non-profit organizations have used MCRS data to inform policy, programs and other activities to address Minnesota's cancer burden including health inequities related to cancer. MCRS data used in this work usually take the form of tables of cancer statistics from specialized "data requests" or queries from the MN Public Health Data Access Portal (https://data.web.health.state.mn.us/web/mndata/). Members of the Minnesota Cancer Alliance rely on these statistics in their efforts to achieve specific objectives in the Cancer Plan Minnesota 2025 (https://mncanceralliance.org/cancer-plan/). The American Cancer Society uses presentations developed by MCRS epidemiologists in workshops to educate stakeholders, primary care providers, and others about cancer prevention and control. For example, MCRS data was recently presented in two different provider educational workshops to increase HPV-vaccination rates in Minnesota and to increase low-dose CT scan screening among persons at high risk for lung cancer.

- **Concerns about cancer**

  MDH epidemiologists and other professionals have used MCRS data to address the public's concerns about cancer. Cancers are much more common than most people realize, and the rates of cancer increase sharply with age. As the baby boom generation ages, Minnesotans will see increasing numbers of family members, other relatives, neighbors, and friends develop and, unfortunately, die from some type of cancer. MCRS data are used to help people understand the trends in cancer occurrence and the risk factors for different cancers. MCRS data also have been used to investigate perceived excesses of cancer in communities. Since 1988, thousands of concerns have been addressed successfully. Published MCRS reports of selected investigations are located on the MCRS Cancer Statistics and Reports page.

C. Feedback Form

Please take a few minutes to provide us with your thoughts and comments about the report, Cancer in Minnesota 1988-2015. Please send your responses to MCRS by US mail or email. Our office mailing address and email address is located below.

We will summarize feedback we receive and use it in planning future reports or other publications. We will not individually identify respondents in our summary and planning.

1. Was the information in the report clearly written and understandable? If you have any suggestions for improvements, please include them in your answer.

2. Please tell us how you will to use the information in this publication?

3. What would be useful in future publications?

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