The University of Iowa | College of Public Health

Cancer in Iowa

2018

In 2018 an estimated 6,300 Iowans will die from cancer, 18 times the number caused by auto fatalities. Heart disease and cancer are the leading causes of death in Iowa. These estimates are based upon mortality data the State Health Registry of Iowa receives from the Iowa Department of Public Health. The Registry has been recording the occurrence of cancer in Iowa since 1973, and is one of fourteen population-based registries and three supplementary registries nationwide providing data to the National Cancer Institute. With *2018 Cancer in Iowa*, the Registry makes a general report to the public on the status of cancer. This report will focus on:

- A description of the Registry and its goals
- Cancer estimates for 2018
- A special section on obesity-related cancers
- Brief summaries of recent/ongoing research projects
- A selected list of publications from 2017

The State Health Registry of Iowa

The State Health Registry of Iowa is the best statewide resource for determining the burden of cancer on the Iowa population and assessing trends in the occurrence of cancer over time.

Cancer is a reportable disease as stated in the Iowa Administrative Code. Cancer data are collected by the State Health Registry of Iowa, also known as the Iowa Cancer Registry. The staff includes 50 people of whom 20 are situated throughout the state, regularly working with hospitals, clinics and medical laboratories in Iowa and neighboring states to collect cancer data. A follow-up program tracks more than 99 percent of the cancer survivors diagnosed since 1973. This program provides regular updates for follow-up and survival. The Registry maintains the confidentiality of the patients, physicians and hospitals providing data.

In 2018 data will be collected on an estimated 17,800 new invasive cancers among Iowa residents. In situ cases of bladder cancer are included in the estimates for bladder cancer, to be in agreement with the definition of reportable cases of the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute (NCI).

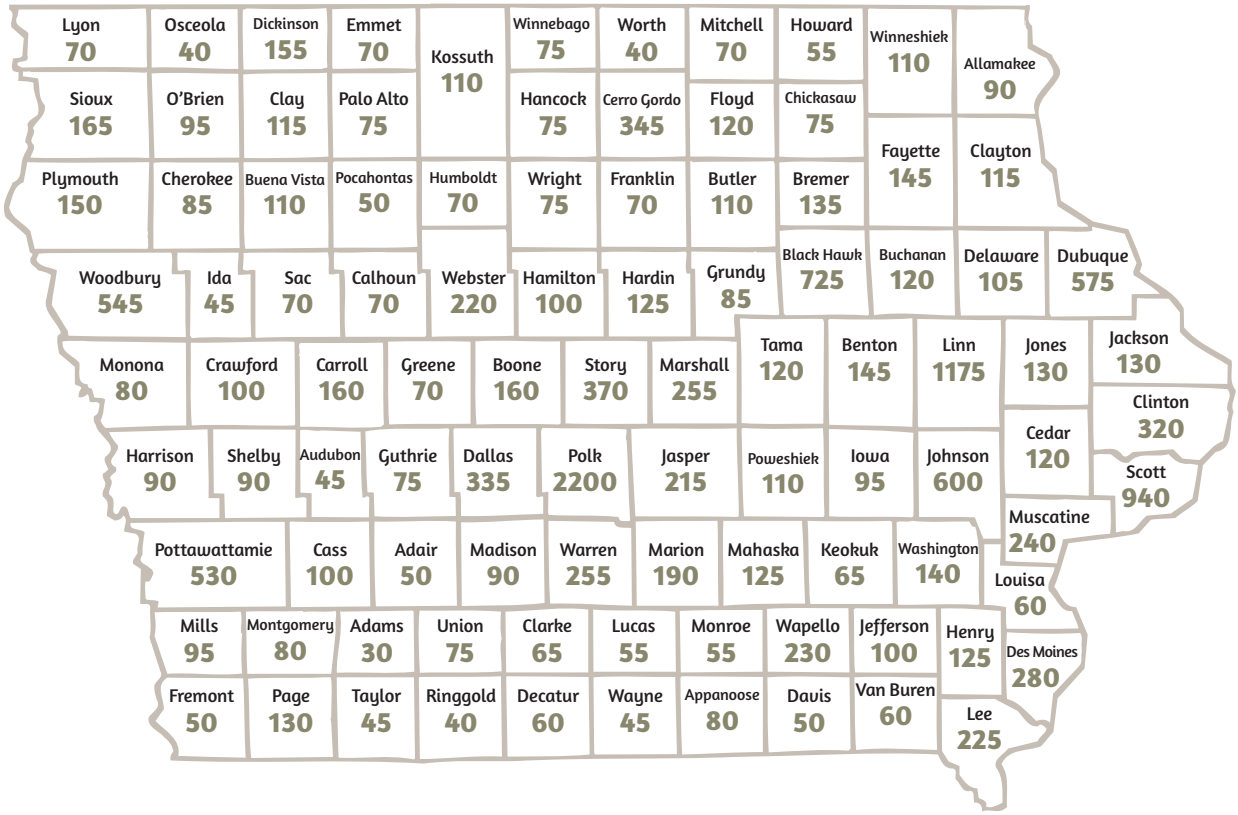
Since 1973 the Iowa Registry has been funded by the NCI SEER Program. Iowa represents rural and Midwestern populations and provides data included in many NCI publications. Beginning in 1990 about 5-10 percent of the Registry's annual operating budget has been provided by the state of Iowa. Since 2003 the University of Iowa has also been providing cost-sharing funds. Additionally, the Registry receives funding through grants and contracts with university, state and national researchers investigating cancer-related topics.

The goals of the Registry are to:

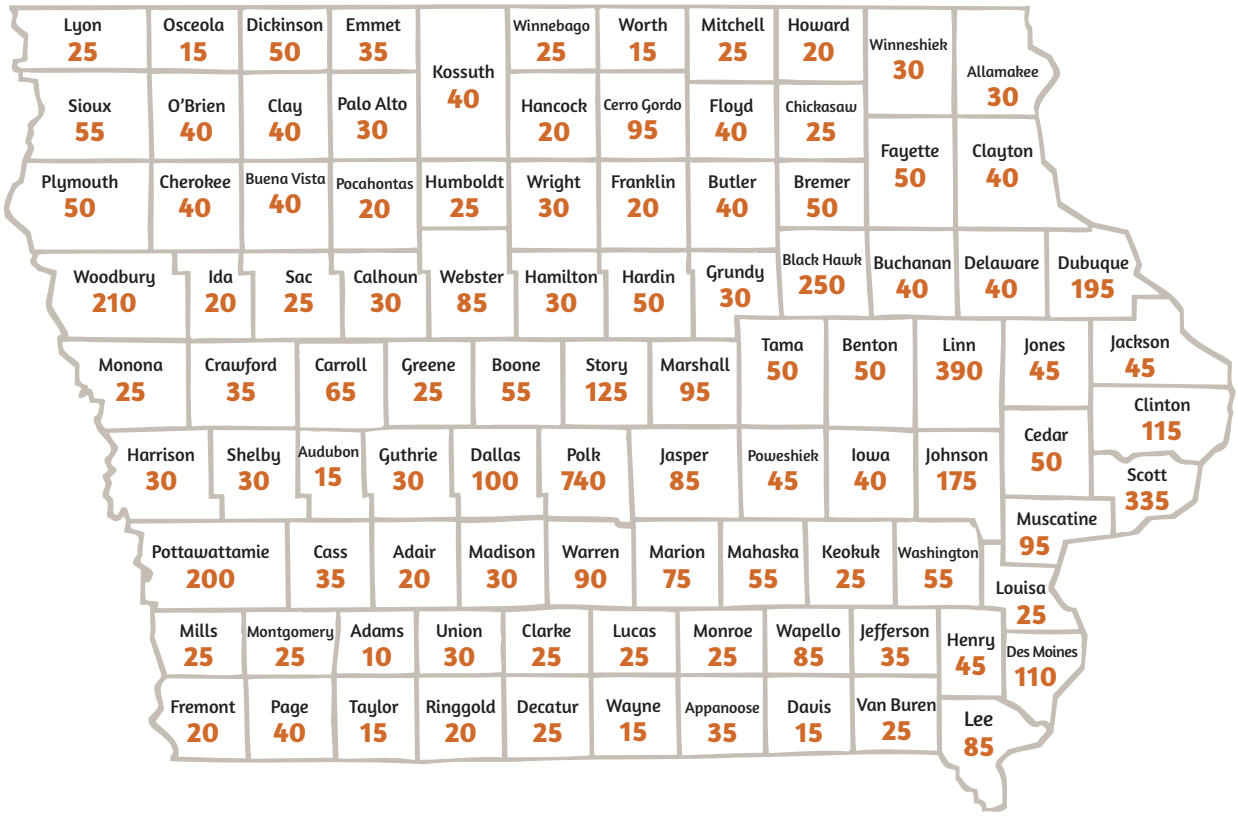
- Assemble and report measurements of cancer incidence, survival and mortality among Iowans
- Provide information on changes over time in the extent of disease at diagnosis, therapy and patient survival
- Promote and conduct studies designed to identify factors relating to cancer etiology, prevention and control
- Respond to requests from individuals and organizations in the state of Iowa for cancer data and analyses
- Provide data and expertise for cancer research activities and educational opportunities

Cancer Estimates for 2018

Estimated Number of New Cancers in Iowa by County for 2018



Estimated Number of Cancer Deaths in Iowa by County for 2018



Top 10 Types of Cancer in Iowa Estimated for 2018

New Cancers in Females

Type	# of Cancers	% of Total
Breast	2400	27.6
Lung	1100	12.6
Colon & Rectum	800	9.2
Uterus	600	6.9
Skin Melanoma	430	4.9
Thyroid	360	4.1
Non-Hodgkin Lymphoma	330	3.8
Kidney & Renal Pelvis	260	3.0
Leukemia	260	3.0
Pancreas	250	2.9
All Others	1910	22.0
Total	**8700**	

Cancer Deaths in Females

Type	# of Cancers	% of Total
Lung	740	24.7
Breast	390	13.0
Colon & Rectum	280	9.3
Pancreas	210	7.0
Ovary	150	5.0
Leukemia	110	3.7
Non-Hodgkin Lymphoma	100	3.3
Uterus	100	3.3
Brain	90	3.0
Multiple Myeloma	60	2.0
All Others	770	25.7
Total	**3000**	

New Cancers in Males

Type	# of Cancers	% of Total
Prostate	2000	22.0
Lung	1320	14.5
Colon & Rectum	860	9.5
Bladder (invasive and noninvasive)	650	7.1
Skin Melanoma	540	5.9
Kidney & Renal Pelvis	430	4.7
Non-Hodgkin Lymphoma	410	4.5
Leukemia	390	4.3
Oral Cavity	330	3.6
Pancreas	260	2.9
All Others	1910	21.0
Total	**9100**	

Cancer Deaths in Males

Type	# of Cancers	% of Total
Lung	900	27.3
Prostate	320	9.7
Colon & Rectum	260	7.9
Pancreas	240	7.3
Leukemia	160	4.9
Esophagus	140	4.2
Non-Hodgkin Lymphoma	140	4.2
Bladder	120	3.6
Kidney & Renal Pelvis	110	3.3
Liver	110	3.3
All Others	800	24.3
Total	**3300**	

Fortunately for Iowans, the chances of being diagnosed with many types of cancer can be reduced through positive health practices such as smoking cessation, physical exercise, healthful dietary habits and alcohol consumption in moderation.

Early detection through self-examination and regular health checkups can improve cancer survival.

Obesity-Related Cancer in Iowa

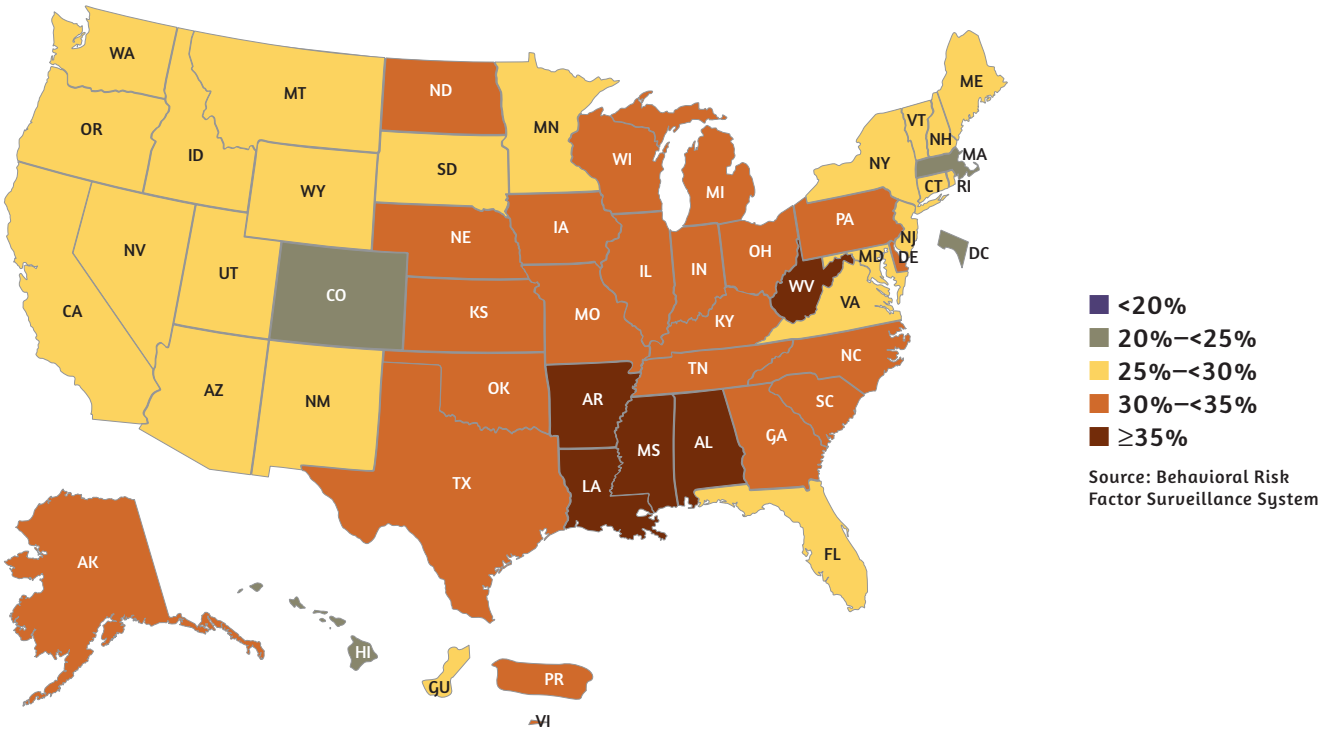
Obesity is a condition in which a person has an unhealthy amount and/or distribution of body fat. A scale known as the body mass index (BMI) is often used to measure obesity because it is a more accurate measure of obesity than weight alone, and for most people it is a fairly good indicator of body fatness. BMI is calculated by dividing a person's weight (in kilograms) by their height (in meters) squared (commonly expressed as kg/m^2).[1] The standard weight categories based on BMI for adults age 20 years or older are the following:

- Underweight: < 18.5
- Normal: 18.5 – 24.9
- Overweight: 25.0 – 29.9
- Obese: 30.0 – 39.9
- Severely Obese: ≥ 40.0

The rate of obesity has been increasing throughout the U.S. and Iowa is no exception. According to the 2017 report called *The State of Obesity: Better Policies for a Healthier America*, Iowa has the 13th highest obesity rate in the nation. Since 1991 the percentage of Iowans with obesity has doubled from 15% to 30% (shown in **Figure 1**), with one in three Iowans currently obese. The high prevalence of obesity likely results from environmental and socioeconomic factors, behavioral factors and inherent genetic and other biological traits that differ among individuals. Obesity disproportionately affects people from certain racial and ethnic minority populations and those who are socio-economically disadvantaged.

While most Americans are aware that obesity increases the risk for numerous health problems including heart disease, stroke and diabetes, only half of Americans are aware that obesity is a major risk factor for cancer. Scientific evidence exists linking excess body weight to higher risk of several types of cancer including colorectal, thyroid, uterine, ovarian, esophageal adenocarcinoma, kidney, pancreatic, liver, gastric (cardia), gallbladder, post-menopausal breast, malignant meningioma and multiple myeloma. These cancer types will be referred to as 'obesity-related' cancers in this report, but this term is not meant to imply that all cases of these cancers were actually caused by obesity. In Iowa in 2015, there were 6,955 cases of obesity-related cancers that accounted for 40% of all cancers.

Figure 1. Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2016



[1]Online BMI calculator:https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm

Table 1. Age-Adjusted Incidence Rates of Obesity-Related Cancers by Sex and Year of Diagnosis, Iowa, 1976–2015

Age-Adjusted Rate per 100,000 Person-Years

		Female Breast (Post-Menopausal)	Colorectal	Endometrial	Kidney	Thyroid	Pancreas	Ovarian	Multiple Myeloma	Liver	Esophageal Adenocarcinoma	Gastric Cardia	Gallbladder
Male	1976–1980	-	73.0	-	9.6	1.9	12.6	-	5.8	2.3	1.2	3.3	1.1
	1981–1985	-	77.6	-	11.3	2.2	14.2	-	6.7	2.4	1.6	3.5	1.0
	1986–1990	-	79.9	-	13.6	3.1	12.9	-	6.3	2.5	2.6	4.3	0.9
	1991–1995	-	74.3	-	14.6	3.4	11.7	-	7.3	3.3	4.2	4.2	0.6
	1996–2000	-	76.3	-	15.8	3.6	13.0	-	6.1	4.3	5.6	4.6	0.8
	2001–2005	-	67.9	-	18.9	5.4	12.8	-	7.0	5.1	7.0	3.9	0.9
	2006–2010	-	57.1	-	22.7	6.7	14.1	-	7.0	6.5	7.6	4.1	0.8
	2011–2015	-	51.1	-	23.3	7.4	14.5	-	8.0	8.2	8.1	3.8	0.8
Female	1976–1980	260.9	60.4	28.2	5.3	5.4	7.8	16.0	3.7	1.2	0.2	0.5	2.6
	1981–1985	281.7	63.5	25.7	5.6	5.9	8.8	16.5	4.3	1.1	0.3	0.6	2.3
	1986–1990	347.3	58.9	24.7	7.2	7.2	8.8	16.6	4.5	1.2	0.4	0.7	2.0
	1991–1995	356.4	54.8	25.6	7.9	9.0	8.8	15.2	4.4	1.3	0.4	0.7	1.9
	1996–2000	370.6	55.5	28.4	8.4	10.4	9.1	15.1	4.3	1.4	0.7	0.7	1.6
	2001–2005	349.2	51.0	27.4	9.9	13.8	10.0	13.8	4.3	1.8	0.8	0.9	1.6
	2006–2010	333.9	44.3	30.1	11.2	18.2	10.3	13.0	4.4	2.1	1.0	0.9	1.3
	2011–2015	335.8	39.3	30.6	11.8	20.7	11.4	11.2	5.1	2.6	1.0	0.8	1.3

*Due to Small Numbers Meningioma Is Not Shown

The exact explanation for the relationship between obesity and cancer risk remains unclear, but it is known that fat tissue is highly active, producing large amounts of hormones like estrogen, insulin and insulin-like growth factors. High estrogen levels have been associated with increased risks of breast, endometrial, ovarian and some other cancers. High levels of insulin and insulin-like growth factors can promote the development of colon, kidney, prostate and endometrial cancers. Fat cells also produce adipokines, which are hormones that can affect cell growth. It has also been proven that people with obesity often have chronic low-level inflammation which can cause DNA damage to cells over time, leading to cancer.

Chronic inflammation caused by gastroesophageal reflux disease is a likely cause of esophageal adenocarcinoma. In addition, chronic ulcerative colitis (a chronic inflammatory condition) and hepatitis (disease of the liver causing inflammation) are risk factors for liver cancer. Obesity is also a risk factor for gallstones, which are related to chronic gallbladder inflammation. A history of gallstones is a strong risk factor for gallbladder cancer.

As the rate of obesity in Iowa has increased over time, so have the rates of many obesity-related cancers among both males and females **(Table 1)**. Female post-menopausal breast cancer is the most common obesity-related cancer in Iowa.

Calculating a BMI

$$\left[\frac{\textbf{Weight (in pounds)}}{(\textbf{Height [in inches]})^2}\right] \times 703$$

Example

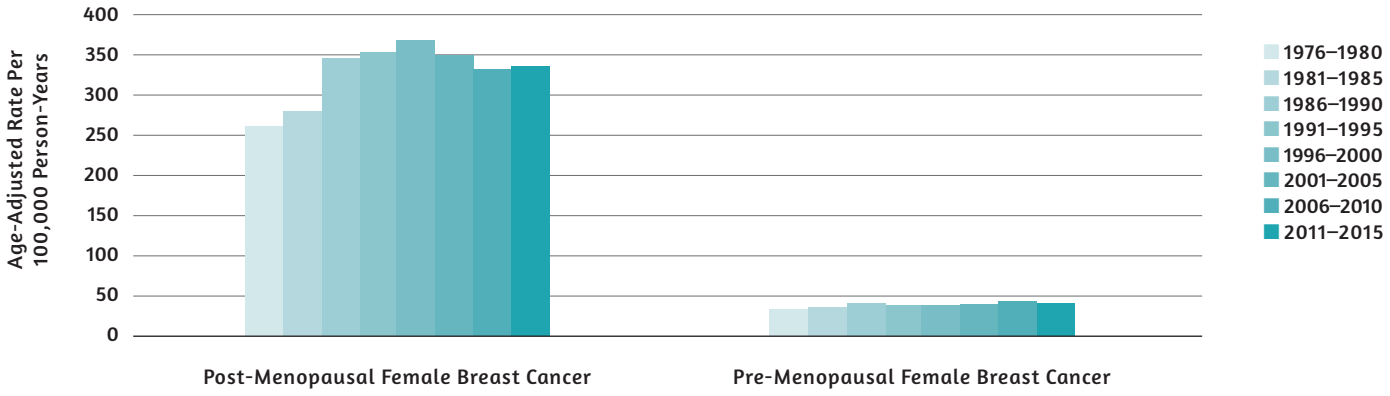
Weight = 148 pounds

Height = 5'5" (65 inches)

$$\left[\frac{148}{65^2}\right] \times 703 = 24.6$$

Physical inactivity is estimated to cause 3.2 million deaths worldwide annually. Inactive adults have a 20–30% higher risk of death compared to adults with 150 minutes of moderate exercise per week. As well as reducing the risk of ischaemic heart disease, stroke and diabetes, regular physical activity is a key component of energy expenditure and is therefore fundamental to energy balance, weight control and the prevention of obesity.

Figure 2. Incidence Rates of Pre-Menopausal (not obesity-related) Versus Post-Menopausal (obesity-related) Female Breast Cancer, Iowa, 1976-2015

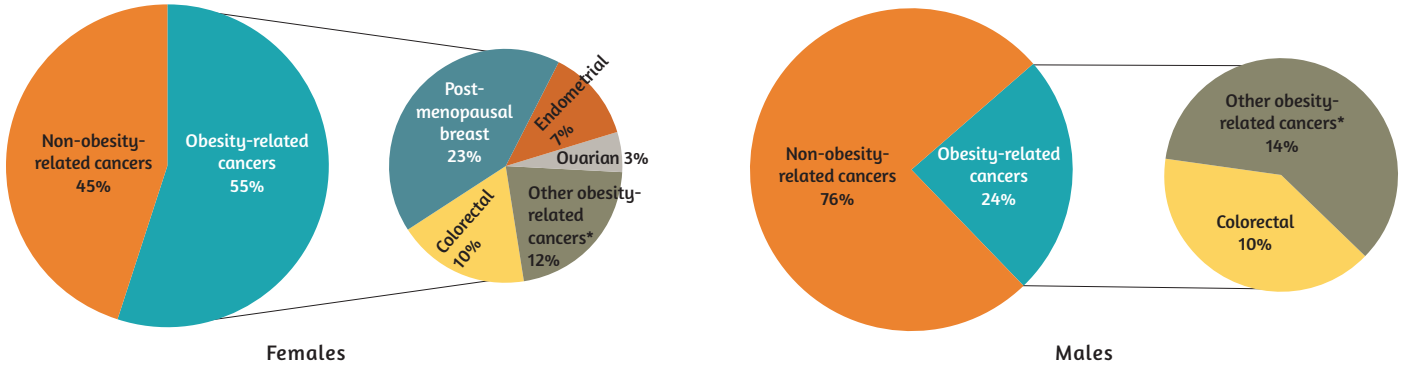


In contrast to pre-menopausal breast cancer, which has not been linked to obesity and has not substantially increased over time, the rate of post-menopausal breast cancer has increased almost 30% from 260 per 100,000 in 1976-1980 to 335 per 100,000 in 2011-2015 **(Figure 2)**.

Colorectal cancer is the second most common obesity-related cancer in Iowa. Colorectal cancer has been declining largely due to the increasing use of guideline-recommended colonoscopy among Iowans over age 50. Colonoscopy can detect and remove polyps before they develop into cancer. Medicare began covering colonoscopies for average-risk beneficiaries in 2001 and rates of colorectal cancer have been declining ever since **(Table 1)**.

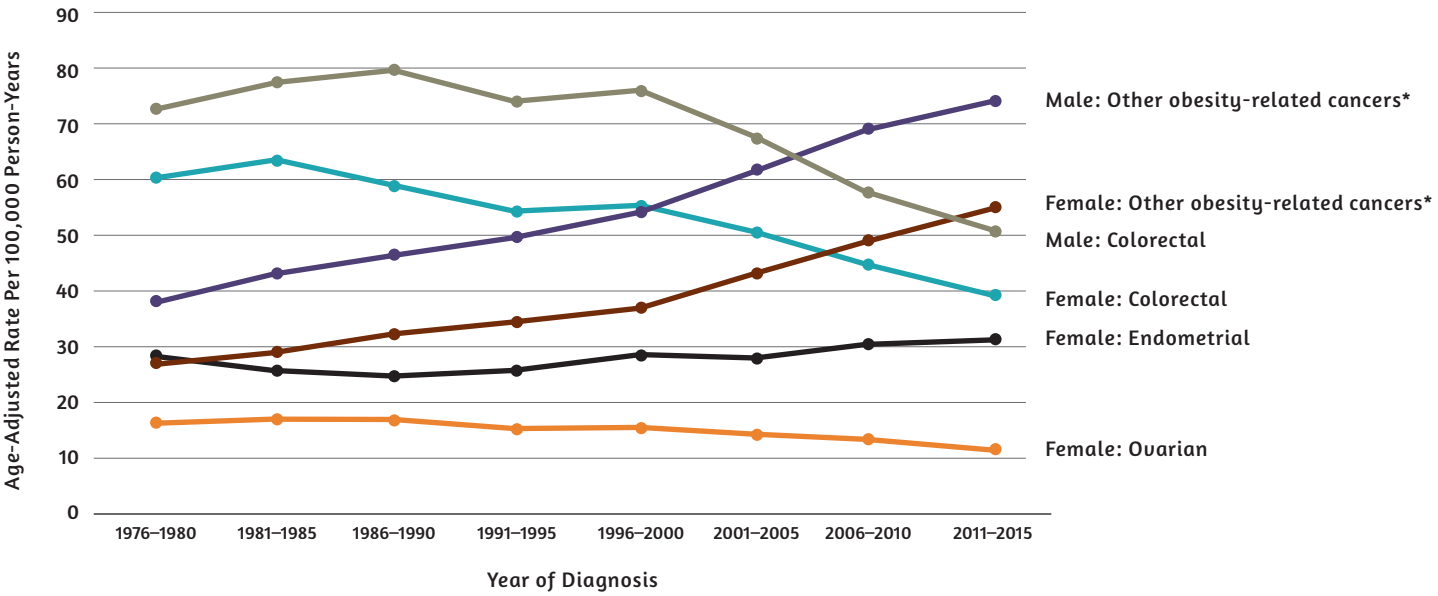
Just over half of new cancers among females (excluding non-melanoma skin cancers) are obesity-related **(Figure 3)** compared to one-quarter among males. In addition to post-menopausal breast cancer, endometrial and ovarian cancers are other obesity-related cancers affecting only females. There has been a slight increase in the incidence of endometrial cancer from 1986-1990 (25 per 100,000) to 2011-2015 (30 per 100,000). Conversely, there has been a decrease in the incidence of ovarian cancer over the time period **(Table 1)**. It is thought that the increasing duration of oral contraceptive use is the reason for the decline in ovarian cancer incidence. **Table 1** shows that most of the other obesity-related cancers among females including kidney, thyroid, pancreatic, multiple myeloma, liver, esophageal adenocarcinoma and gastric cardia (the part of

Figure 3. Percentages of Obesity-Related Versus Non-Obesity-Related Cancers in Females and Males, Iowa, 2011–2015



*Other obesity-related cancers include: kidney, thyroid, pancreas, multiple myeloma, liver, esophageal adenocarcinoma, gastric cardia, gallbladder and meningioma

Figure 4. Age-Adjusted Incidence Rates of Obesity-Related Cancers for Males and Females, Iowa, 1976–2015



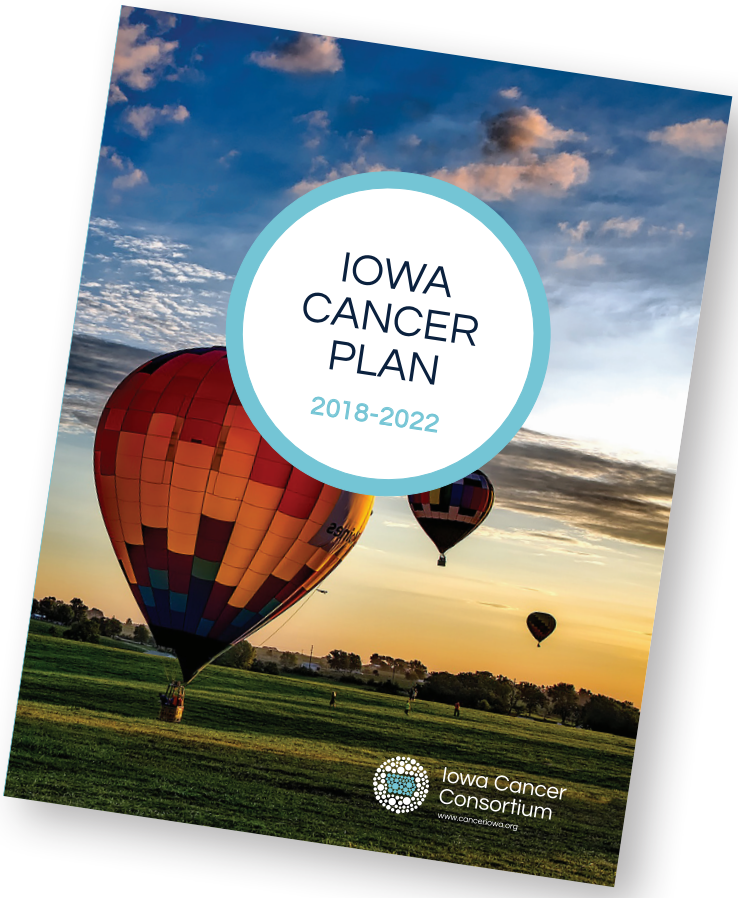
*Other obesity-related cancers include: kidney, thyroid, pancreas, multiple myeloma, liver, esophageal adenocarcinoma, gastric cardia, gallbladder and meningioma

the stomach closest to the esophagus) have been steadily increasing over time, with the exception of gallbladder cancer. **Figure 4** shows that the overall incidence rate of these other obesity-related cancers (excluding post-menopausal breast, colorectal, endometrial and ovarian) has doubled from 27 per 100,000 in 1976-1980 to 54 per 100,000 in 2011-2015.

Table 1 shows that most of the other obesity-related cancers among males have also been increasing with the exceptions of gastric cardia and gallbladder cancers, which have remained fairly stable. **Figure 4** shows that among males, the overall incidence rate of other obesity-related cancers (excluding colorectal) has doubled from 38 per 100,000 in 1976–1980 to 74 per 100,000 in 2011–2015.

Prevention

There is no simple solution to the obesity epidemic; it is a complex problem that requires a multifaceted approach. There are many policy, systems and environmental changes that can help prevent and reduce obesity. The recently revised Iowa Cancer Plan includes "Increase efforts that support healthy eating, physical activity and healthy weight status" as one of 15 goals to prevent and control cancer in Iowa.



A few examples of changes that can be made in various settings are:

Daycares: Provide meals and snacks that meet United States Department of Agriculture (USDA) standards and promote physical activity.

Schools: Have an active recess and provide meals and snacks that meet USDA standards.

Worksites and other organizations: Place motivational signs near the elevators to encourage people to use the stairs; increase access to and availability of healthy food and beverage choices (vending machines, cafeteria, food offered as part of meetings); and support breastfeeding in the workplace.

Healthcare settings: Follow the U.S. Preventive Services Task Force (USPSTF) recommendations to screen patients for obesity; refer patients with obesity to intensive, multicomponent behavioral intervention programs; ensure the healthcare organization has an environment and policies that support physical activity and nutrition (see worksite recommendations above); support breastfeeding; and prescribe exercise to patients.

Communities: Improve community design and infrastructure to create environments that support increased physical activity (sidewalks, bike lanes, complete streets policies, supporting public transportation, etc.); increase access to and availability of healthy food and beverage choices (in grocery stores, convenience stores, government buildings); support parks and recreation departments; restrict child-focused advertising for unhealthy foods and beverages; tax sugar-sweetened beverages; and require nutritional labeling in restaurants.

Iowa is part of a national effort focusing on obesity prevention efforts funded by the Centers for Disease Control and Prevention (CDC). In Iowa, this effort is called the Health Promotion and Chronic Disease Partnership. The goals of this effort are healthier people living in healthier communities, improved prevention and control of diabetes, heart disease and obesity, and promotion of health in schools.

Iowa is also participating in a public-private initiative called 5-2-1-0 — Healthy Choices Count, which is part of a nationally recognized childhood obesity prevention program that focuses on the importance of the following four simple daily health habits:

- Five or more servings of fruits and vegetables
- Two hours or less of recreational screen time (television, computer, video games, phones, etc.)
- One hour or more of physical activity
- Zero sugary beverages and drink more water

The initiative is sponsored by the Iowa Department of Public Health, Healthiest State Initiative and United Way of Central Iowa. To learn more, go to http://www.iowahealthieststate.com/resources/individuals/5210/.

Individuals can also take steps to prevent obesity or lose weight by eating healthy, getting regular physical activity and balancing the number of calories consumed with the number of calories used by their body. You can take steps to prevent or lose unhealthy weight gain by:

- **Eating five or more servings of fruits and vegetables daily. Many fruits and vegetables are naturally low in fat and calories and are filling.**
  - **One vegetable serving = 1 cup of raw or ½ cup of cooked vegetables**
  - **One fruit serving = 1 piece of small or medium fresh fruit, ½ cup of canned or ¼ cup of dried fruit**
- **Substituting fruits or veggies in place of a high-calorie ingredient will add volume to your meal**
- **Choosing whole grains like brown rice or whole wheat bread**
- **Eating smaller portions of foods**
- **Accumulating at least 30 minutes or more of moderate-intensity activity every day**

Research Projects During 2018

The Iowa Cancer Registry (ICR) is participating in over 80 open studies during 2018 that have been approved by the University of Iowa Human Subjects Office. Brief descriptions of a few of these studies are provided.

AGRICULTURAL HEALTH STUDY

The Agricultural Health Study (AHS) is a long-term study of agricultural exposures (including pesticides) and chronic disease (especially cancer) among commercial or private pesticide applicators (and their spouses, if married) in Iowa and North Carolina. The study is funded through the National Cancer Institute (NCI) and involves several federal agencies. We are in the 26th year of the study.

In the first five years, 89,658 subjects (58,564 in Iowa and 31,094 in North Carolina) were enrolled in the study. The total for Iowa included 31,877 private applicators, 21,771 spouses of private applicators, and 4,916 commercial applicators. Enrollment consisted of completing questionnaires about past exposures and health. The second phase of the study for private applicators and their spouses was completed at the end of 2003. It involved a telephone interview, a mailed dietary questionnaire, and collection of a cheek cell sample from all consenting cohort members. The telephone interview asked about pesticide use since enrollment, current farming and work practices, and health changes. The dietary health questionnaire asked about cooking practices and types of foods eaten, since cooking practices and diet may play a role in cancer and other health conditions. The cheek cells are being used to understand possible links between genetics, exposures, and disease. For commercial applicators, the second phase of the study was completed at the end of 2005. The study's third phase began in 2005 and ended in 2010. It involved updating information about exposures and health. The fourth phase of the study occurred from 2011 into 2018 and for the University of Iowa research team primarily involved the collection of cheek cells from AHS participants diagnosed with cancer and the collection of blood, urine, cheek cells and dust samples from a select subgroup of AHS male participants. During this fourth phase health histories have also been updated.

Since 1997, cohort members have been linked annually or biennially to mortality and cancer registry incidence databases in both states. In addition, mortality data on the cohort are being obtained from the National Death Index. More information about results from this study, the study background, frequently asked questions, other resources (internet & telephone) for agricultural health information, references for publications to date, and information for scientific collaborators can be found at the website, http://aghealth.nci.nih.gov/. This study's data have also been pooled with data from other cohort studies and analyzed as collaborative activities. The titles for over 265 publications from this study linked to PubMed are available at the website. The cancer-related references for 2017 publications are provided in the last section of this report.

PATTERNS OF CARE STUDIES

SEER Patterns of Care Studies are conducted to satisfy a U.S. Congressional directive to the NCI to "assess the incorporation of state-of-the-art cancer treatment into clinical practice and the extent to which cancer patients receive such treatments." This year's Patterns of Care (POC) Study will investigate state-of-the-art therapies for patients with cancers diagnosed during 2016 involving the head and neck, pancreas, or uterus. The objectives of the SEER Patterns of Care Study are to: 1) describe the use of adjuvant therapy, which, when applicable, will be verified with the treating physician or with a unified record; 2) characterize the practice patterns

in different communities; 3) describe more completely the use of surgery as treatment; 4) compare the patterns of treatment (surgery, radiation therapy, chemotherapy, immunotherapy, hormonal therapy) over time and by age, sex, race/ethnicity, and insurance status; 5) describe the co-morbidities and their effect on treatment, 6) describe treatment by hospital characteristics (i.e., profit vs. not for profit, teaching vs. non-teaching, bed size, etc.), 7) describe the use of diagnostic tests and compare their use by demographic variables and geographic region, 8) describe the use of biomarkers, 9) match the Patterns of Care data with the SEER-Medicare linked files as appropriate by age, and 10) compare the outcomes in community practice to the outcomes obtained in clinical trials. The ICR has been involved with these types of studies over the past 25 years. Publications during 2017 that resulted from these studies are provided in the last section of this report.

SECOND CANCER STUDIES INCLUDING THE WECARE STUDY

Over the past three decades, the ICR has participated in several second cancer studies. These have consisted of cohorts with a first cancer of the cervix, ovary, testis, uterus, female breast, non-Hodgkin lymphoma, or Hodgkin lymphoma. They have been conducted primarily in collaboration with Radiation Epidemiology Branch at the NCI and other registries in North America and Europe. Generally these studies evaluate the treatment received for the first cancer and the risk it places on the patient for development of a second cancer. They typically involve medical record review and pathology material retrieval. We are evaluating esophagus, pancreas, and stomach as second cancer sites in several of these cohorts, mentioned above, with a first cancer.

The WECARE (Women's Environmental Cancer and Radiation Epidemiology) Study is an example of a second cancer study. This study is designed to examine gene carrier status, demographic and lifestyle factors, as well as environmental and treatment factors reported to be associated with an initial breast cancer as they relate to the development of a second breast cancer in the opposite breast. Eligible cases were diagnosed with a first breast cancer between 1985 and 2009 that did not spread beyond the regional lymph nodes at diagnosis and a second primary contralateral breast cancer diagnosed at least one year after the first breast cancer diagnosis. Eligible controls were women with unilateral breast cancer who were individually matched to cases on year of birth, year of diagnosis, registry region, and race. The controls must have survived without any subsequent diagnosis of cancer and with an intact contralateral breast during the interval that elapsed between their matched case's first and second breast cancer diagnoses. Data collection not only involved medical record review, but also participant interviews and biosample collection, either cheek cells, saliva, or blood. More recently, the WECARE staff collected mammographic film data for its research subjects to evaluate breast density as another risk factor for a subsequent diagnosis of invasive breast cancer in the contralateral breast. A listing of publications during 2017 from second cancer studies, including the WECARE Study, is provided in the last section of this report.

SEER-MEDICARE

In the early 1990s, the cancer incidence and survival data from the ICR was combined with other SEER Registry data and linked to Medicare data. This linked data set has been updated on several occasions since and has become an important data resource for cancer research involving epidemiologic and health services research related to the diagnosis and treatment procedures, costs, and survival of cancer patients. Over the years over 1700 publications have resulted from this linked data set including over 150 during 2017, which are listed at http://healthservices.cancer.gov/seermedicare/overview/publications.html.

SEER-MEDICARE HEALTH SURVEYS

In 2003, the ICR obtained human subjects research approval for a new project to link SEER data with the Centers for Medicare and Medicaid (CMS) Medicare Health Outcomes Survey (MHOS). Similar approval was obtained in 2009 for linkage to the Consumer Assessment of Healthcare Providers & Systems (CAHPS) surveys. The SEER-MHOS linked data provided a wide range of potential research applications focused on health-related quality of life of cancer patients and cancer survivors. The SEER-CAHPS linked data allows for research applications focused on patient experiences with care across health plan types. A listing of publications during 2017 is provided in the last section of this report.

STUDIES INVOLVING TISSUE

Today, researchers are increasingly looking to obtain tissue to study molecular characteristics of cancers. Several studies that involve the ICR have included tissue. For example, in 2015 we began a three-year study to determine the capability of the ICR to obtain formalin-fixed, paraffin-embedded tissue to accompany data that already exists in the registry's surveillance database for breast and pancreatic cancers meeting eligibility criteria for this study. The objectives of this SEER-linked virtual tissue repository project are to: 1) assess the ability of the ICR to serve as a resource for biospecimen research, 2) locate cases with biospecimens in pathology labs and determine the requirements to retrieve those biospecimens for research purposes, 3) provide custom annotation of specified data items for located cases, and 4) capture costs for objectives 2 and 3. This project involves other NCI SEER cancer registries and when completed will provide for an assessment of NCI SEER's capabilities to perform this type of study. During 2017, this study was expanded to include obtaining pancreatic tissue to conduct genomic sequencing of cases and controls included in this study with the goal of identifying somatic mutations in primary tumors that correlate with survival outcomes.

In 2017 the ICR joined the Kentucky and Louisianan cancer registries in a collaborative study with the Centers for Disease Prevention and Control (CDC) to obtain tissue from HPV-related cancers to determine the HPV vaccine impact. Tissue collection in Iowa for over 400 cancer cases will be completed in 2018 with data analysis and publication of findings to follow.

Other tissue-based studies are currently ongoing including one with the WECARE Study. During 2017, a few articles involving tissue from Iowans were published, the references for which are provided in the last section of this report.

TRANSPLANT CANCER MATCH STUDY

Solid organ transplantation provides life-saving treatment for end-stage organ disease but is associated with substantially elevated cancer risk, largely due to the need to maintain long-term immunosuppression. Important questions remain concerning the role of immunosuppression and other factors in causing cancer in this setting. Staff at two federal agencies, the NCI and the Health Resources and Services Administration (HRSA), have created a database through linkage of information beginning in 1987 on over 285,000 U.S. transplant recipients, wait list candidates (over 120,000 in addition to those who were subsequently transplanted), and donors (over 60,000 deceased donors, over 50,000 living donors) with information on cancer from 17 U.S. cancer registries, including the ICR. These data are being used to conduct research concerning the spectrum of cancer risk in transplant recipients. The data will also be used by HRSA in its public health role overseeing the U.S. solid organ transplant network to maintain and improve safety of organ transplantation, and will allow NCI to better characterize the burden of cancer in this population and discover additional factors associated with cancer among this population. Several publications have resulted from the findings and those that occurred in 2017 are provided in the last section of this report.

COOPERATIVE AGREEMENTS AND OTHER REGISTRIES

In the Midwest, the ICR maintains cooperative agreements with several hospital cancer registries and other agencies/entities. Some of the latter include:

- Iowa Department of Public Health
- Iowa Cancer Consortium
- The University of Iowa
    - Center for Health Effects of Environmental Contamination
    - Center for Health Policy and Research
    - Center for Public Health Statistics
    - Environmental Health Sciences Research Center
    - Health Effectiveness Research Center
    - Holden Comprehensive Cancer Center
    - Iowa Center for Agricultural Safety and Health
    - Iowa Center for Education and Research on Therapeutics (Iowa CERT)
    - Injury Prevention Research Center
    - Nutrition Center
    - Prevention Research Center for Rural Health
    - Preventive Intervention Center
    - Reproductive Molecular Epidemiology Research & Education Program

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