
The University of Iowa
College of Public Health
STATE HEALTH REGISTRY OF IOWA
Cancer in Iowa
2013

In 2013, an estimated 6,400 Iowans will die from cancer, 17 times the number caused by auto fatalities. Cancer and heart disease are the leading causes of death in Iowa. These projections 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 *2013 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 2013;
- a special section on breast cancer;
- brief summaries of recent/ongoing research projects;
- a selected list of publications from 2012.

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, located at The University of Iowa in the College of Public Health's Department of Epidemiology. The staff includes more than 50 people. Half of them, situated throughout the state, regularly visit hospitals, clinics, and medical laboratories in Iowa and neighboring states to collect cancer data. Hospital cancer programs approved by the American College of Surgeons also report their 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 2013 data will be collected on an estimated 17,300 new 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.

Since 1973 the Iowa Registry has been funded by the SEER Program of the National Cancer Institute. 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.

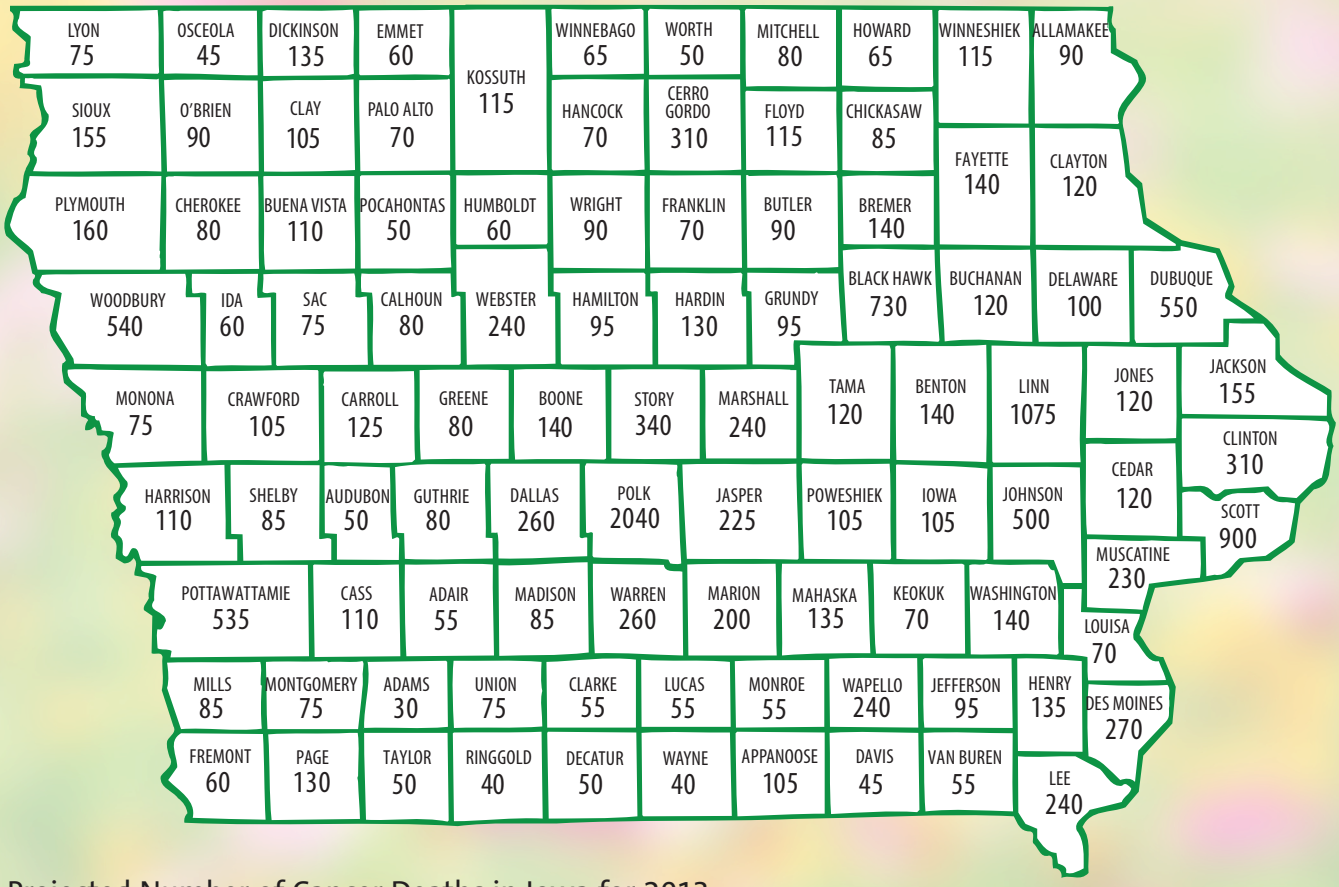
Starting in 2003, the University of Iowa has also been providing cost-sharing funds. In addition the Registry receives funding through grants and contracts with university, state, and national researchers investigating cancer-related topics.

The goals of the Registry are to:

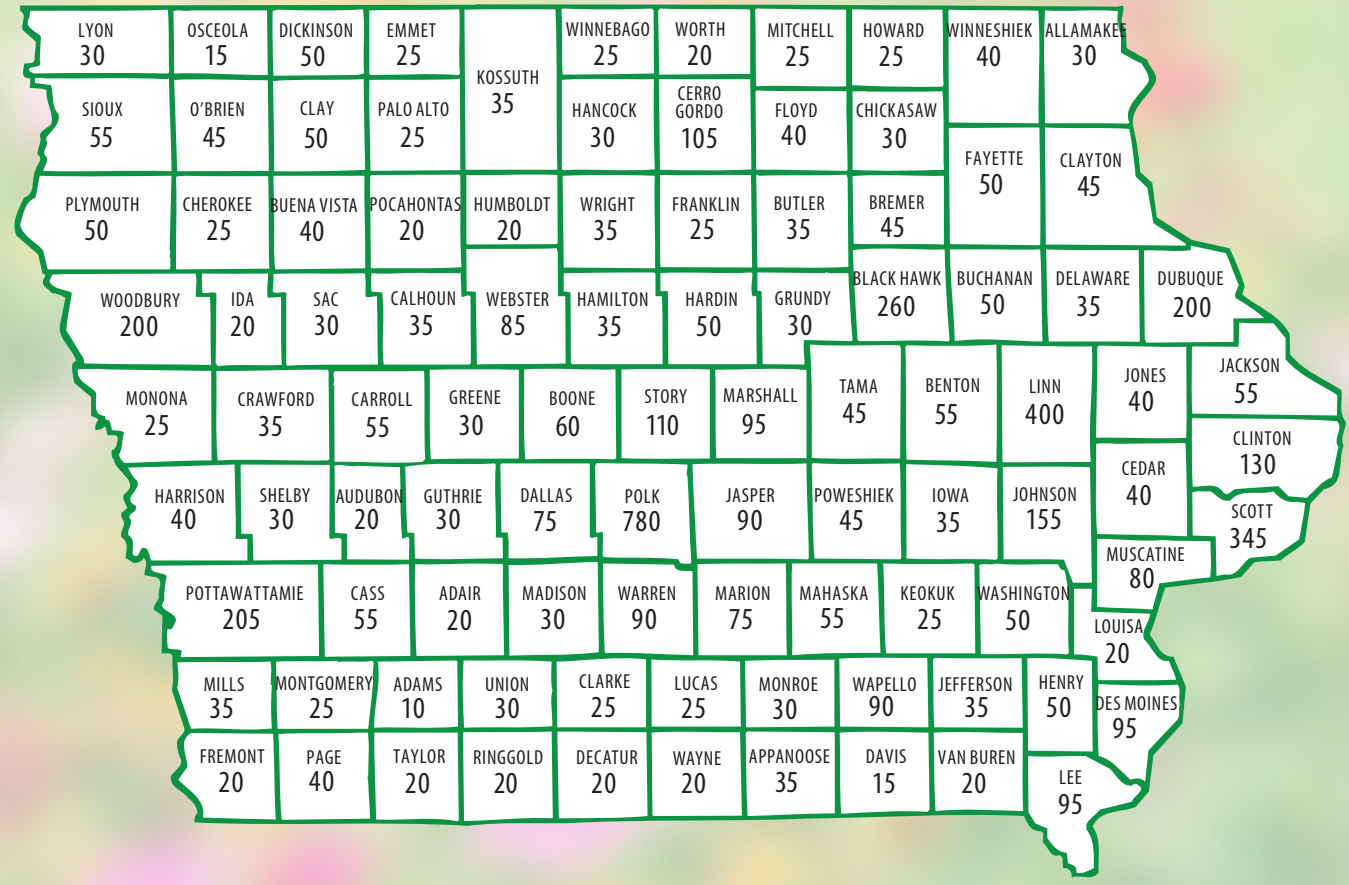
- assemble and report measurements of cancer incidence, survival and mortality among Iowans;
- provide information on changes over time in the extent of disease at diagnosis, therapy, and patient survival;
- promote and conduct studies designed to identify factors relating to cancer etiology, prevention 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 Projections for 2013

Projected Number of New Cancers in Iowa for 2013



Projected Number of Cancer Deaths in Iowa for 2013



Top 10 Types of Cancer in Iowa Estimated for 2013

NEW CANCERS IN FEMALES

Type	# of Cancers	% of Total
Breast	2300	27.4
Lung	1000	11.9
Colon & Rectum	800	9.5
Uterus	650	7.7
Skin Melanoma	380	4.5
Non-Hodgkin Lymphoma	370	4.4
Thyroid	300	3.6
Ovary	240	2.9
Leukemia	230	2.7
Kidney & Renal Pelvis	210	2.5
All Others	1920	22.9
Total	**8400**	

CANCER DEATHS IN FEMALES

Type	# of Cancers	% of Total
Lung	710	23.7
Breast	410	13.7
Colon & Rectum	320	10.7
Pancreas	200	6.7
Ovary	180	6.0
Non-Hodgkin Lymphoma	120	4.0
Leukemia	120	4.0
Uterus	110	3.6
Brain	70	2.3
Kidney & Renal Pelvis	60	2.0
All Others	700	23.3
Total	**3000**	

NEW CANCERS IN MALES

Type	# of Cancers	% of Total
Prostate	2200	24.7
Lung	1300	14.6
Colon & Rectum	840	9.4
Bladder (invasive and noninvasive)	630	7.1
Skin Melanoma	460	5.2
Non-Hodgkin Lymphoma	430	4.8
Kidney & Renal Pelvis	390	4.4
Leukemia	290	3.3
Oral Cavity	260	2.9
Pancreas	240	2.7
All Others	1860	20.9
Total	**8900**	

CANCER DEATHS IN MALES

Type	# of Cancers	% of Total
Lung	990	29.1
Colon & Rectum	330	9.7
Prostate	320	9.4
Pancreas	200	5.9
Leukemia	150	4.4
Esophagus	140	4.1
Non-Hodgkin Lymphoma	140	4.1
Bladder	120	3.5
Kidney & Renal Pelvis	110	3.2
Liver	100	3.0
All Others	800	23.6
Total	**3400**	

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.

Breast Cancer in Iowa Women

Breast cancer is the most commonly registered cancer among women in Iowa. Today, there are over 33,000 women in Iowa living with a diagnosis of breast cancer. Between 1976 and 2010, there were 79,092 newly diagnosed *in situ* (confined to the lobular or ductal lining of the breast) and invasive breast cancers. Age-adjusted invasive female breast cancer incidence (new cases) rates during this 35-year period were stable from 1976 to 1982, rose steeply from 1983 through 1988, were stable from 1989 to 1998, and declined slightly from 1999 to 2010 (Figure 1). Breast cancer can also occur in men, but data show it is 150 times less likely as there are less than 20 cases per year in Iowa.

Breast cancer has been the underlying cause of death for 17,089 Iowa women between 1976 and 2010. Age-adjusted breast cancer mortality rates were stable from 1976 to 1992, then decreased an appreciable 40% through 2010 (Figure 2). The 2010 rate of 19.4 approached the goal of 19.0 set several years prior in the statewide plan to improve the health of Iowans, called *Healthy Iowans 2010*.

Demographic differences exist for females regarding both incidence and mortality rates. Increasing age is a very strong risk factor for both breast cancer incidence and mortality. Over 72% of these cancers diagnosed between 1976 and 2010 occurred in women age 55 years and older; only 10% were diagnosed in women less than 45 years of age. For women dying from breast cancer during this same time period, 82% of these deaths occurred in women age 55 years and older, while only 6% occurred in women less than 45 years of age. Rural counties compared to urban counties in Iowa have both slightly lower age-adjusted incidence and mortality rates for female breast cancer. Similar to the national experience, Whites compared to Blacks in Iowa have a slightly higher age-adjusted incidence rate for female breast cancer, but Blacks have a higher age-adjusted mortality rate. Over the 35-year period, these relationships with age, urban/rural counties, and race have persisted with the exception of urban/rural counties where during the 2000-2010 period the female mortality rates in rural counties caught up to the urban counties' rates.

Most breast cancer risk factors reflect a woman's lifetime exposure to estrogen and possibly progesterone. These factors include early age at first menses, late age at menopause, having no children or having a first birth at a later age, lack of or short-term breast feeding, obesity after menopause, long-term use of hormone

Figure 1. Annual in situ and invasive breast cancer incidence rates, Iowa, 1976-2010
(Rates are per 100,000 and are age-adjusted to 2000 U.S. standard population)

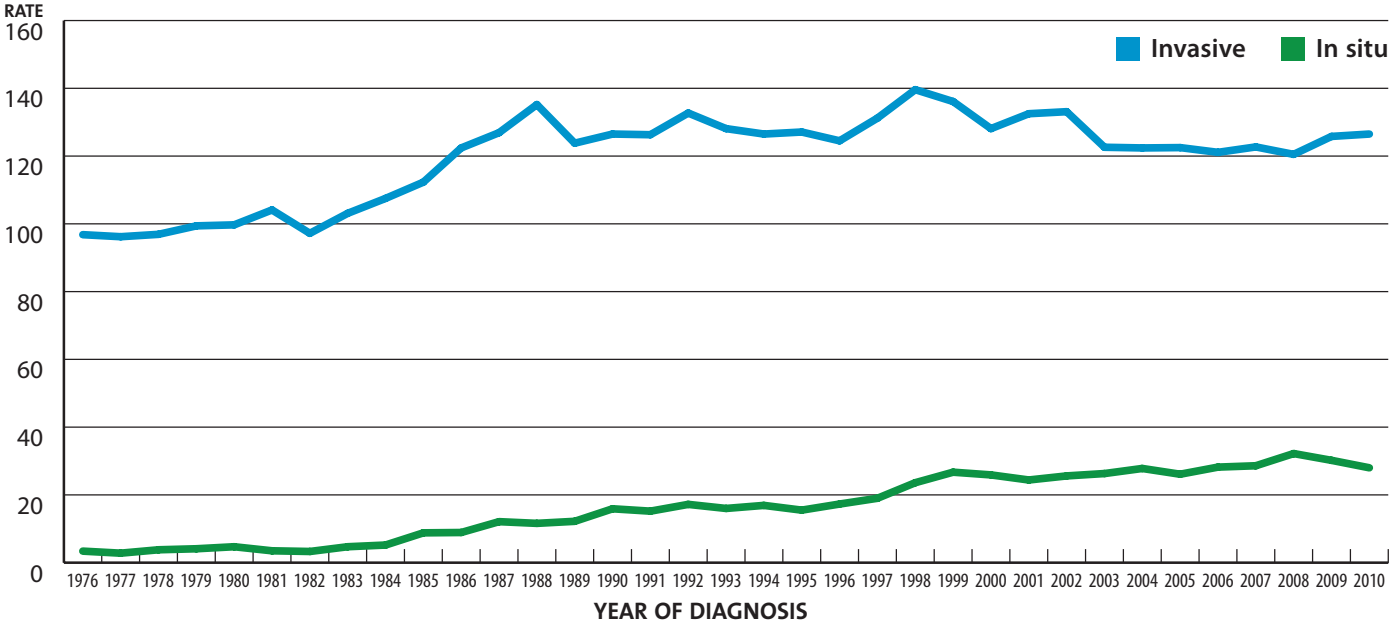
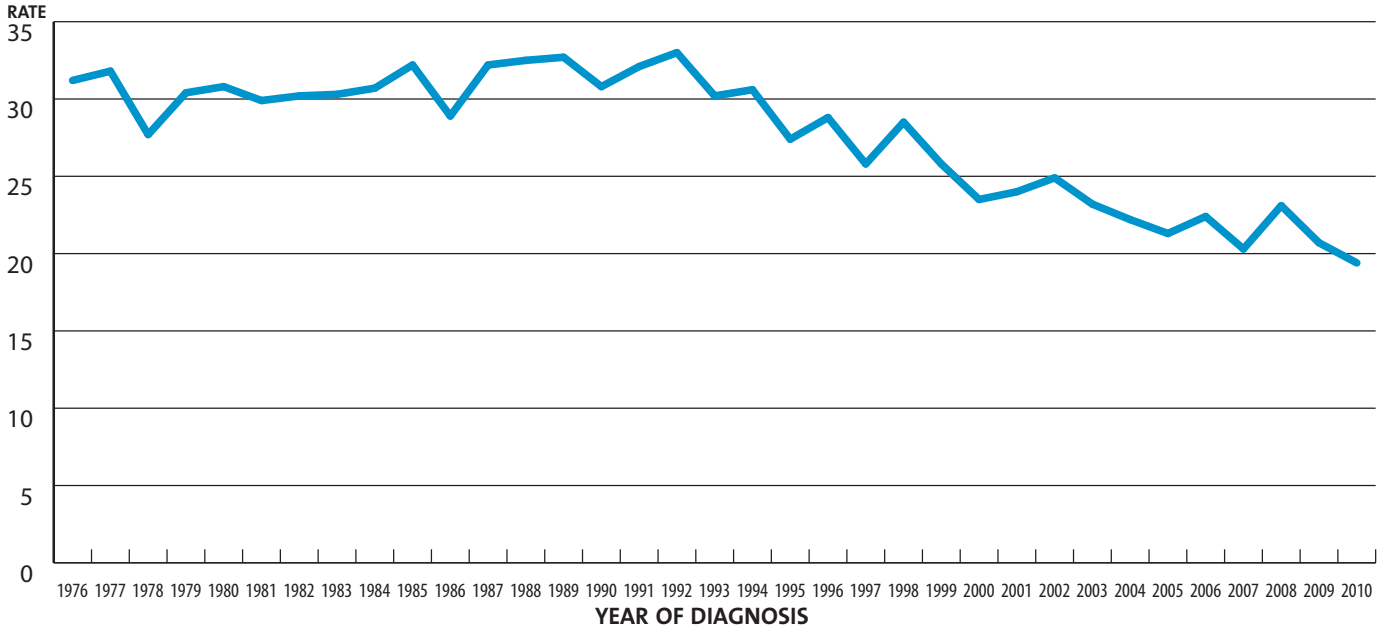


Figure 2. Annual breast cancer mortality rates, Iowa, 1976-2010
(Rates are per 100,000 and are age-adjusted to 2000 U.S. standard population)



replacement therapy, and alcohol intake of at least one drink per day. The most important breast cancer risk factor is genetic predisposition often reflected in first-degree relatives (mother, sister, daughter) who have been diagnosed with breast cancer or ovarian cancer. This is likely due to inherited genes, the most established of which are BRCA1 and BRCA2. High mammographic breast density and radiation exposure are other established, important risk factors.

Breast cancer control centers on women getting mammograms. The American Cancer Society currently recommends that women in the general population begin obtaining an annual mammogram and clinical breast exam at age 40 years. Women with genetic predisposition should pursue annual breast cancer screening tests for early detection even before the age of 40. Through these early detection tests, breast cancers can be detected while still confined to the lobular or ductal lining of the breast tissue from which they arise, so called *in situ* breast cancers. The annual rates of this behavior of breast cancer have increased 6-fold in Iowa since 1984, as shown in Figure 1, and are directly attributable to the increasing utilization of mammography, the single most effective method of early detection. In 2010, based on Behavioral Risk Factor Surveillance System data, there remain an estimated 24% of Iowa women age 40 years and older reporting not having had a mammogram in the past two years. This percent has changed little since the year 2000. This percent also varies by age group and even more strongly varies by education with over 40% of women with less than high school education reporting not having had a mammogram in the past two years (Figure 3). Annual screening is successful because there are effective treatment options for early stage breast cancer that prolong survival, thereby decreasing the rate of breast cancer deaths.

One of the keys to reducing death from breast cancer is to detect it at an early stage. At time of diagnosis, early stage breast cancers are those confined to the breast, whereas late stage breast cancers have spread beyond the breast. As can be seen in Figure 4, 7 out of every ten newly diagnosed breast cancers have been early stage since the 1991 to 1995 period. This compares with only 5 out of every ten being early stage in the 1976 to 1985 periods. In 2010, the 28% with late stage disease is similar to the 24% reporting not having had a mammogram in the past two years.

Survival rates for breast cancer have been increasing. For women diagnosed with breast cancer in 2001-2005, the 5-year relative survival rate was 100% for early stage disease and 77% for late stage disease (Figure 5). Late stage disease includes as a subgroup women who had spread of their breast cancer to distant organs at the time of diagnosis. This subgroup's 5-year relative survival rate was 29%. Fortunately, this subgroup comprises only 4% of all breast cancers diagnosed during 2001-2005. Early detection via mammography and improved treatment have been reported as the factors most responsible for the increasing female breast cancer survival rates.

Today, molecular subtyping of breast cancer tissue is used in planning treatment and developing new therapies. There are four major molecular subtypes determined by using molecular and genetic information from breast cancer cells. Hormone receptor status and Her2/neu status are molecular markers measured to assist in determining these subtypes (Table 1). For 1,523 female invasive breast cancers newly diagnosed in 2010 in Iowa, the luminal A subtype was the most frequent. The other three subtypes were far less frequent and led by the triple negative subtype. The percent distribution of these subtypes varied by age at diagnosis with triple negative having its highest percent under age 45 years at diagnosis, whereas luminal A always had the largest percent in any age group but this percent increased with increasing

Figure 3. Percent of Iowa female population in 2010 who reported NOT having a mammogram within the past two years

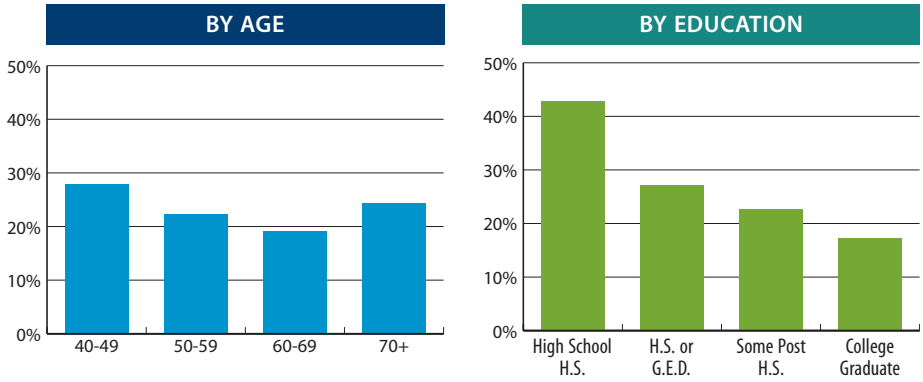


Figure 4. Frequency distribution of female breast cancer by stage, Iowa, 1976-2010

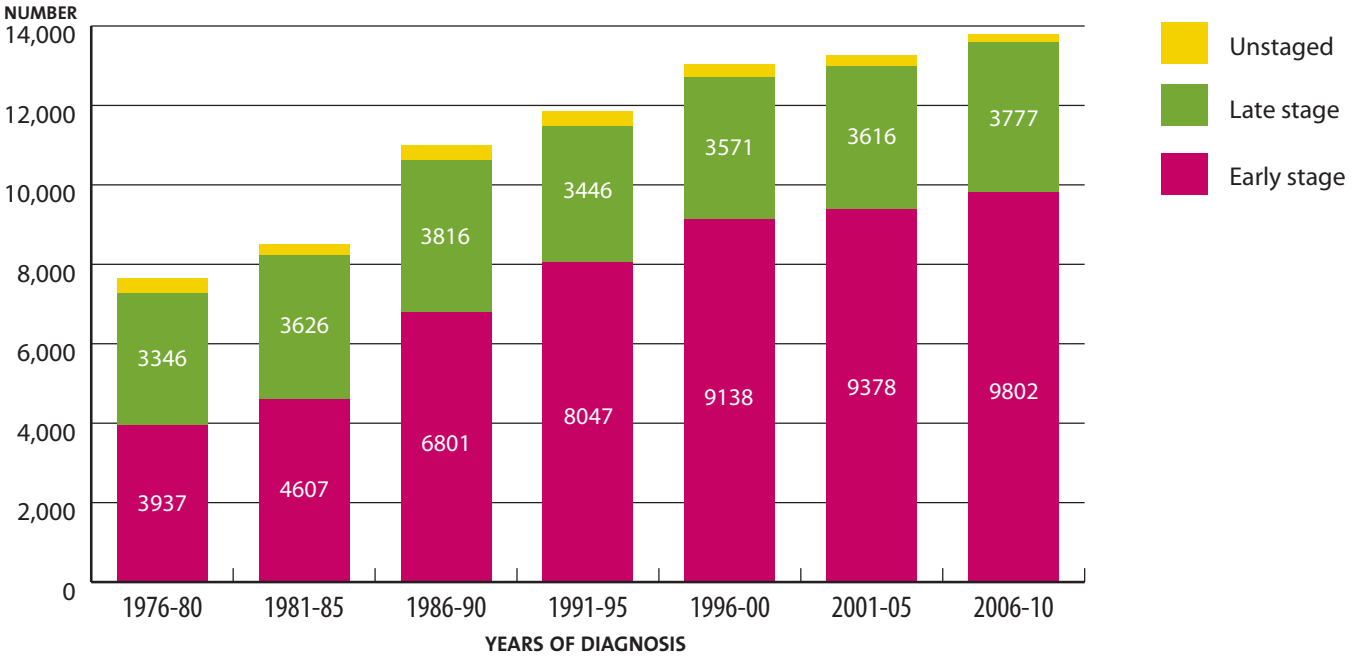
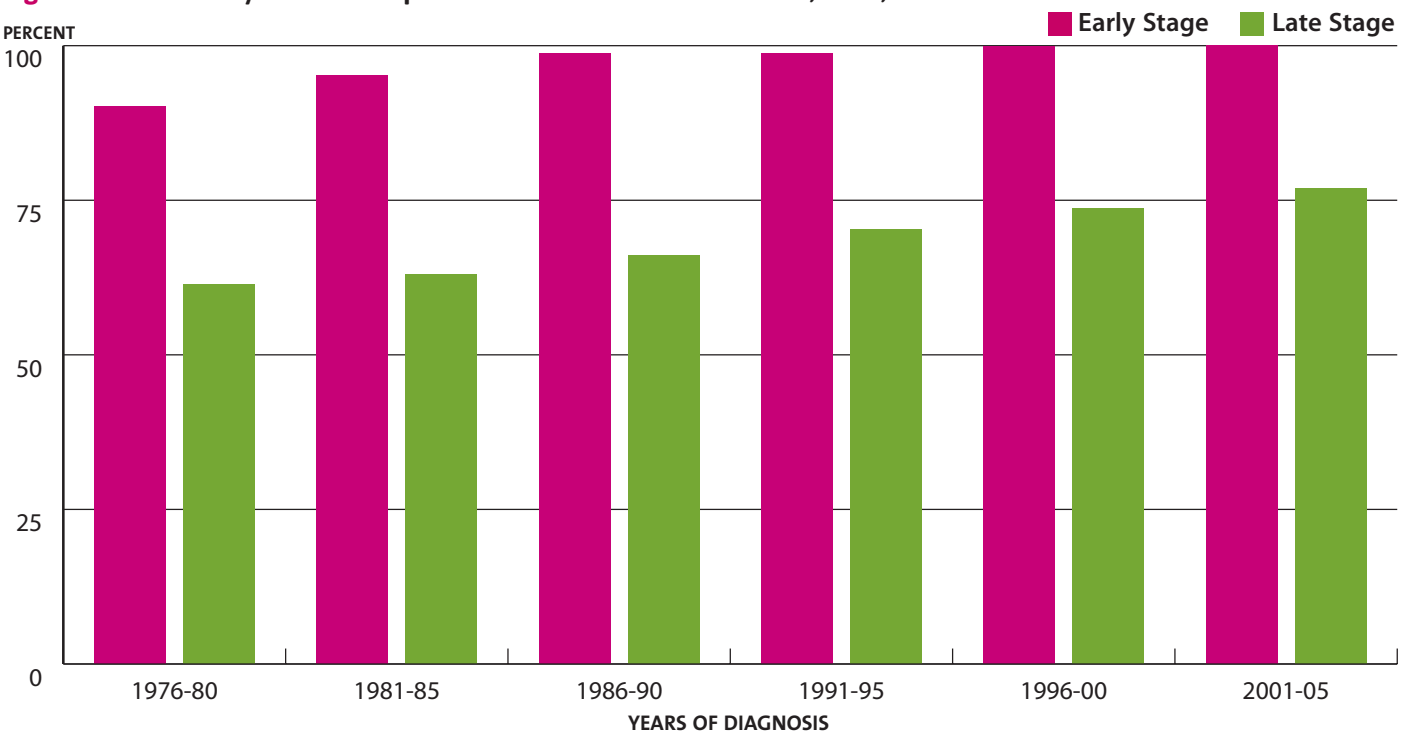


Figure 5. Relative 5-year survival percents for female breast cancer, Iowa, 1976-2005



age. The Iowa data are consistent with the White race data for the entire United States.

Prognosis and treatment decisions are guided by tumor stage, hormone receptor status, and HER2/neu status. Triple negative tumors are usually treated with some combination of surgery, radiation therapy and chemotherapy. These tumors cannot be treated with hormone therapies because the tumor cells, being hormone receptor negative, do not respond to such therapies. The other three tumor subtypes can all include hormone therapies in their treatment regimens. Luminal A cancers tend to have the best survival; triple negative cancers have the poorest survival.

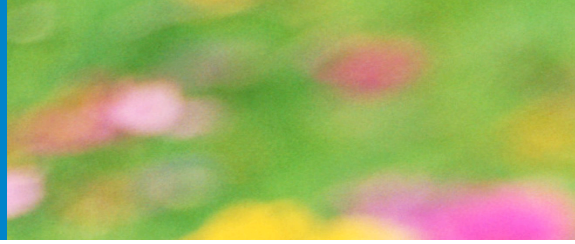
Table 1. Frequency distribution of molecular subtypes for breast cancer cells in Iowa females with newly diagnosed invasive breast cancer in 2010, all ages

Subtype	Markers*	Number	Percent
Luminal A	ER+ and/or PR+, HER2-	1,133	74.4
Luminal B	ER+ and/or PR+, HER2+	136	8.9
HER2/neu	ER-, PR-, HER2+	75	4.9
Triple negative	ER-, PR-, HER2-	179	11.8
Total*		1,523	100.0

ER+ = estrogen receptor-positive; ER- = estrogen receptor-negative; PR+ = progesterone receptor-positive; PR- = progesterone receptor-negative; HER2+ = HER2/neu-positive; HER2- = HER2/neu-negative

*Includes only those breast cancers that had markers measured to allow subtype classification; 824 of the 2,347 (35%) invasive breast cancers diagnosed in 2010 were not classifiable

Research Projects During 2013



The State Health Registry of Iowa is participating in over 60 studies approved by the University of Iowa Human Subjects Office during 2013. 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 and involves several federal agencies. We are in the 21st 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 began in the fall of 2011 and for the University of Iowa research team primarily involves collection of blood and urine samples from a select subgroup of AHS male participants and collection of buccal cells from AHS participants diagnosed with cancer.

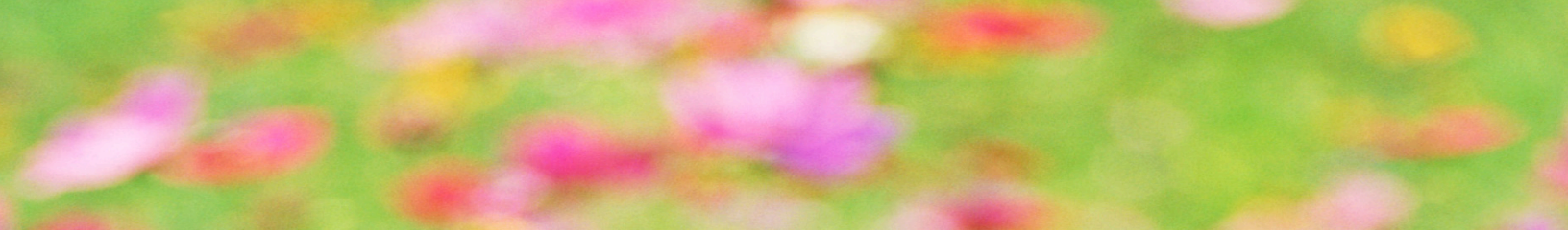
Since 1997, cohort members have been linked annually to mortality and cancer registry incidence databases in both states. In addition, mortality data on the cohort are being obtained from the National Death Index. More information about results from this study, the study background, frequently asked 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/. The titles for over 175 publications from this study linked to PubMed are available at the website. The cancer-related references for 2012 publications are provided in the last section of this report.

IOWA WOMEN'S HEALTH STUDY

This is a population-based cohort of 41,837 Iowa women, aged 55-69, who were recruited in 1986 to determine whether diet, body fat distribution and other risk factors are related to cancer incidence. Exposure and lifestyle information was collected in a baseline mailed survey and subsequently in several follow-up mailed surveys. Mortality and cancer incidence have been ascertained since 1986 through annual linkage to the State Health Registry of Iowa databases and the National Death Index. In 2010 the study was funded for years 25-29. This study's data have also been pooled with data from other cohort studies and analyzed as international collaborative activities. Over time, this has led to over 240 cancer-related publications, some of which occurred in 2012 and are listed in the references provided in the last section of this report.

NON-HODGKIN LYMPHOMA (NHL) CASE-CONTROL STUDY

The State Health Registry of Iowa (SHRI) with other investigators at the Mayo Clinic participated in a collaborative, population-based case-control study of NHL involving researchers at the National Cancer Institute and three other Surveillance, Epidemiology, and End Results (SEER) registries. The main objective of the study was to better characterize risk factors for NHL. In Iowa, 364 live patients newly diagnosed with NHL between July 1, 1998 and June 30, 2000 were



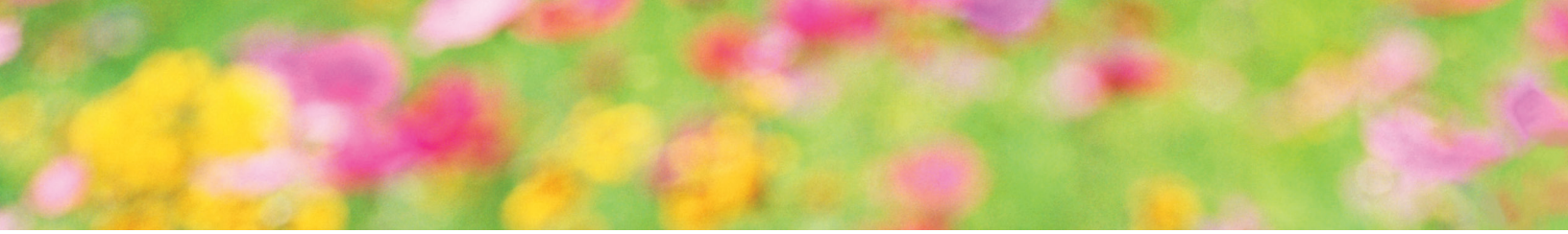
enrolled. A similar number of population controls participated. Blood samples were sought from study participants. The SHRI also coordinated the acquisition of pathology reports, slides and tissue blocks from all SEER centers. The slides were reviewed to determine the reliability of NHL pathologic classification. More recently, we are collaborating with researchers to investigate whether genes with functional, common variant polymorphisms involved in immune function and regulation are associated with overall survival from NHL among these patients. To achieve this aim, medical record reviews were performed to obtain more detailed information on the treatment received for NHL. This study's data have also been pooled with data from other NHL case-control studies and analyzed as part of the InterLymph Consortium, a group of international investigators who discuss and undertake research activities with these data. All of these research activities resulted in several publications during 2012. The references for these 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 National Cancer Institute 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 Study will involve mesothelioma, ovarian, and metastatic melanoma cancers in adults and brain cancers in both children and adults diagnosed between January 1, 2011 and December 31, 2011. Neuroblastoma cancers will also be included in both children and adults diagnosed between January 1, 2010 and December 31, 2011. The objectives of the SEER Patterns of Care Study are to: 1) describe the use of adjuvant therapy, which has been verified with the treating physician, in a community setting, 2) characterize the practice patterns in different communities, 3) describe more completely the use of surgery in the treatment of specific cancers, 4) compare the patterns of treatment for cancer over time, 5) compare patterns of care by age and race/ethnicity, 6) describe effect of co-morbid conditions on treatment, and 7) describe treatment by hospital characteristics: i.e. for profit vs. not for profit, teaching vs. non-teaching, disproportionate share status, etc. The SHRI has been involved with these types of studies over the past 20 years. Publications during 2012 are provided in the last section of this report.

AYA HOPE STUDY

The Adolescent and Young Adult (AYA) Health Outcomes and Patient Experience (HOPE) Study is another ongoing example of a cancer survivor study. This study is an initial step in addressing potential factors related to gaps in research, care and outcomes. From 7 SEER Registries across the United States, 525 patients (40 in Iowa), 15-39 years old at diagnosis between July 1, 2007 and October 31, 2008 have been enrolled with any of the following cancers: ovarian or testicular cancer, Hodgkin lymphoma, non-Hodgkin lymphoma, acute lymphoblastic leukemia, or selected types of sarcoma. Those who responded were representative of all AYA cancer survivors during this time period. 91% of the 525 have completed a subsequent survey 8 to 17 months after the initial survey to obtain additional follow-up information regarding their cancer survivorship experience. During 2012, additional publications have reported findings from this study and are 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 State Health Registry of Iowa have included tissue. During 2012, several articles involving tissue from Iowans were published, the references for which are provided in the last section of this report.

THE WECARE STUDY

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 or blood. The WECARE staff will be collecting mammographic film data for its research subjects in 2013 and 2014 to evaluate breast density as a risk factor for a subsequent diagnosis of invasive breast cancer in the contralateral breast. A listing of publications from the WECARE Study during 2012 are provided in the last section of this report.

SEER-MEDICARE

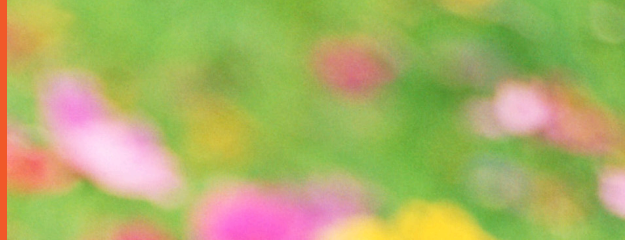
In the early 1990s, the cancer incidence and survival data from the State Health Registry of Iowa was combined with other SEER Registry data and linked to Medicare data. This linked data set has been updated on several occasions since and has become an important data resource for cancer research involving epidemiologic and health services research related to the diagnosis and treatment procedures, costs, and survival of cancer patients. Over the years many publications have resulted from this linked data set including several during 2012, which are listed at http://healthservices.cancer.gov/seermedicare/overview/publications.html.

COOPERATIVE AGREEMENTS AND OTHER REGISTRIES

In the Midwest, the SHRI 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
  - Preventive Intervention Center
  - Reproductive Molecular Epidemiology Research & Education Program

Selected 2012 Publications



AGRICULTURAL HEALTH STUDY

Alavanja MC, Bonner MR. Occupational pesticide exposures and cancer risk: A review. J Toxicol Environ Health B Crit Rev. 2012 May;15(4):238-63.

Andreotti G, Koutros S, Berndt SI, et al. The interaction between pesticide use and genetic variants involved in lipid metabolism on prostate cancer risk. J Cancer Epidemiol. 2012;2012:358076.

Barry KH, Koutros S, Andreotti G, et al. Genetic variation in nucleotide excision repair pathway genes, pesticide exposure and prostate cancer risk. Carcinogenesis. 2012 Feb;33(2):331-7.

Barry KH, Koutros S, Lubin JH, et al. Methyl bromide exposure and cancer risk in the agricultural health study. Cancer Causes Control. 2012 Jun;23(6):807-18.

Beane Freeman LE, Deroos AJ, Koutros S, et al. Poultry and livestock exposure and cancer risk among farmers in the agricultural health study. Cancer Causes Control. 2012 May;23(5):663-70.

Dellavalle CT, Hoppin JA, Hines CJ, Andreotti G, Alavanja MC. Risk-accepting personality and personal protective equipment use within the agricultural health study. J Agromedicine. 2012 Jul;17(3):264-76.

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IOWA WOMEN'S HEALTH STUDY

Ahmed RL, Schmitz KH, Prizment AE, Folsom AR. Risk factors for lymphedema in breast cancer survivors, the iowa women's health study. Breast Cancer Res Treat;130(3):981-991, 2011.

Bao Y, Michaud DS, Spiegelman D, Albanes D, Anderson KE, Bernstein L, van den Brandt PA, English DR, Freudenheim JL, Fuchs CS, Giles GG, Giovannucci E, Goldbohm RA, Hakansson N, Horn-Ross PL, Jacobs EJ, Kitahara CM, Marshall JR, Miller AB, Robien K, Rohan TE, Schatzkin A, Stevens VL, Stolzenberg-Solomon RZ, Virtamo J, Wolk A, Ziegler RG, Smith-Warner SA. Folate intake and risk of pancreatic cancer: Pooled analysis of prospective cohort studies. J Natl Cancer Inst;103(24):1840-1850, 2011.

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Johnson DR, Olson JE, Vierkant RA, Hammack JE, Wang AH, Folsom AR, Virnig BA, Cerhan JR. Risk factors for meningioma in postmenopausal women: Results from the iowa women's health study. Neuro Oncol;13(9):1011-1019, 2011.

Mursu J, Robien K, Harnack LJ, Park K, Jacobs DR,Jr. Dietary supplements and mortality rate in older women: The iowa women's health study. Arch Intern Med;171(18):1625-1633, 2011.

Oppeneer SJ, Robien K. Tea consumption and epithelial ovarian cancer risk: A systematic review of observational studies. Nutr Cancer;63(6):817-826, 2011.

Prizment AE, Alonso A, Folsom AR, Ahmed RL, Virnig BA, Warshaw EM, Anderson KE. Association between psoriasis and incident cancer: The iowa's women's health study. Cancer Causes Control;22(7):1003-1010, 2011.

Uccella S, Mariani A, Wang AH, Vierkant RA, Robien K, Anderson KE, Cerhan JR. Dietary and supplemental intake of one-carbon nutrients and the risk of type I and type II endometrial cancer: A prospective cohort study. Ann Oncol;22(9):2129-2136, 2011.

NON-HODGKIN LYMPHOMA (NHL) CASE-CONTROL STUDY

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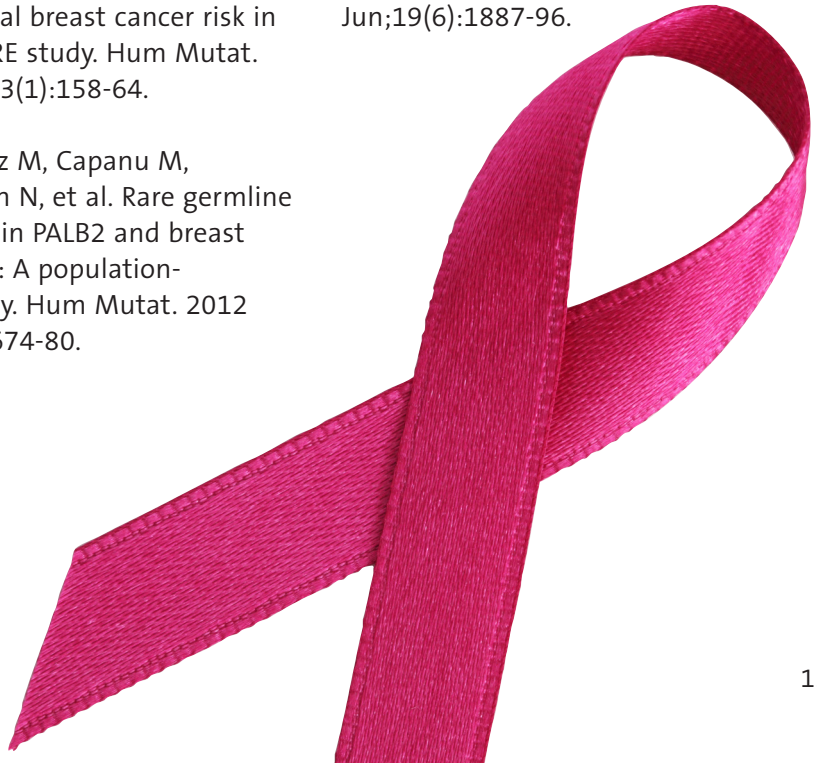

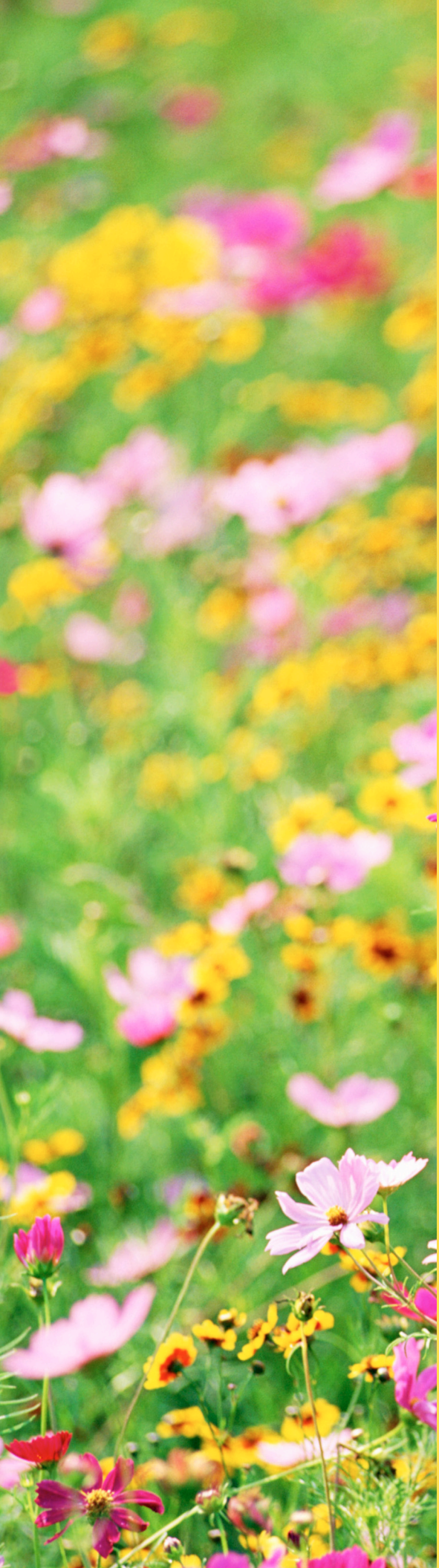

Prepared By

Michele M. West, Ph.D.
Coordinator for Special Projects

Charles F. Lynch, M.D., Ph.D.
Principal Investigator

Kathleen M. McKeen
Director

Daniel B. Olson, M.S.
Programmer Analyst

Charles E. Platz, M.D.
Investigator

Mary E. Charlton, Ph.D.
Investigator

Sonia L. Sugg, M.D.
Associate Professor, Division of Surgical Oncology and Endocrine Surgery

George Weiner, M.D.
Director, Holden Comprehensive Cancer Center
Professor, Department of Internal Medicine

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