

STATE HEALTH REGISTRY OF IOWA

2012

CANCER IN IOWA

A Focus on Lung Cancer

In 2012, a projected 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 (NCI). With *2012 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 projections for 2012;
- * a special section on lung cancer;
- * brief summaries of recent/ongoing research projects;
- * a selected list of publications from 2011.

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.

THE STATE HEALTH REGISTRY OF IOWA

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. 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 2012 data will be collected on a projected 17,500 new cancers

among Iowa residents. In situ cases of bladder cancer are included in the projections for bladder cancer, to be in agreement with the definition of reportable cases of the Surveillance, Epidemiology, and End Results (SEER) Program of the NCI.

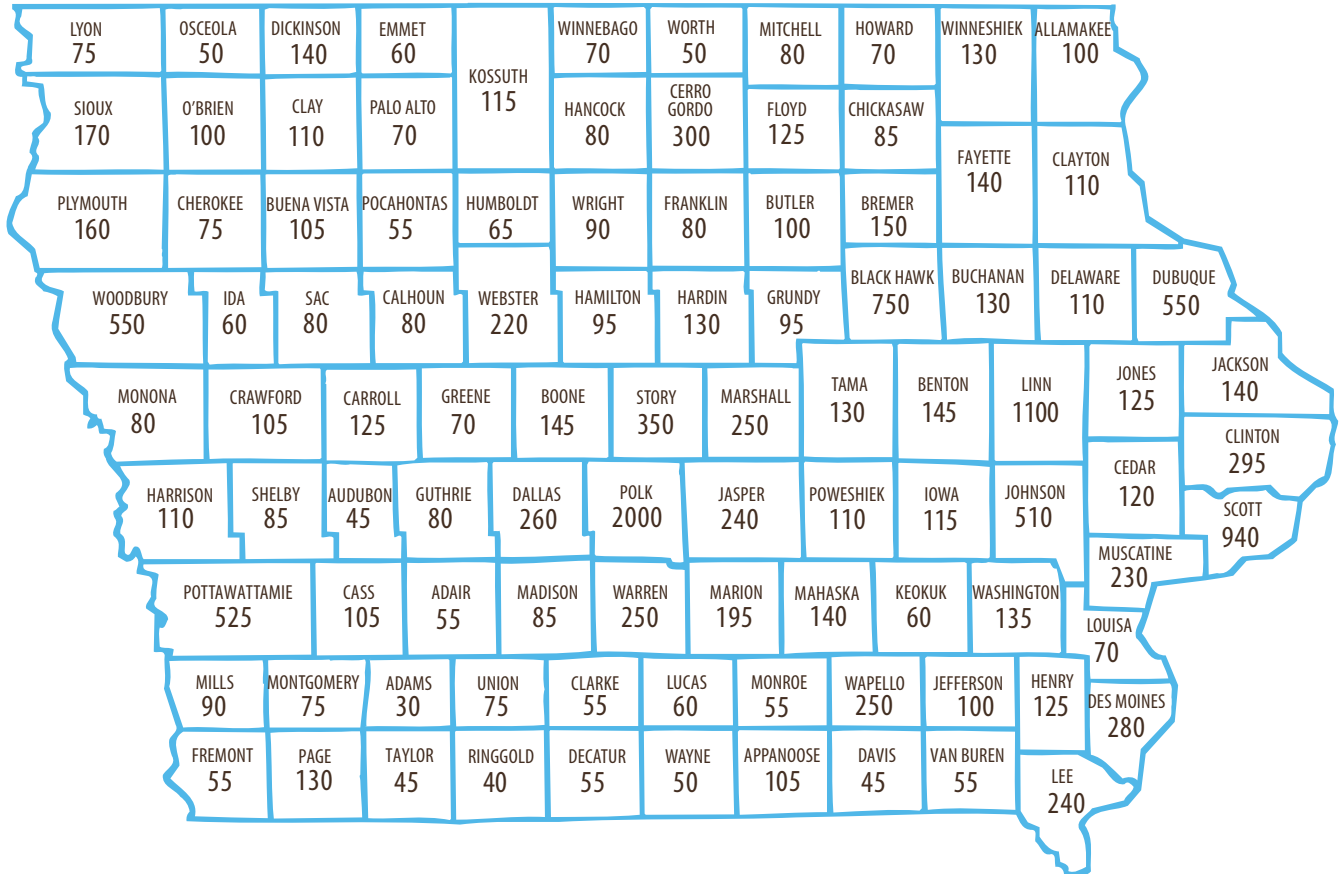
Since 1973 the Iowa Registry has been funded by the SEER Program of the NCI. Iowa represents rural and Midwestern populations and provides data included in many NCI publications. Beginning in 1990 about 5-10 percent of the Registry's annual operating budget has been provided by the state of Iowa. Beginning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

The goals of the Registry are to:

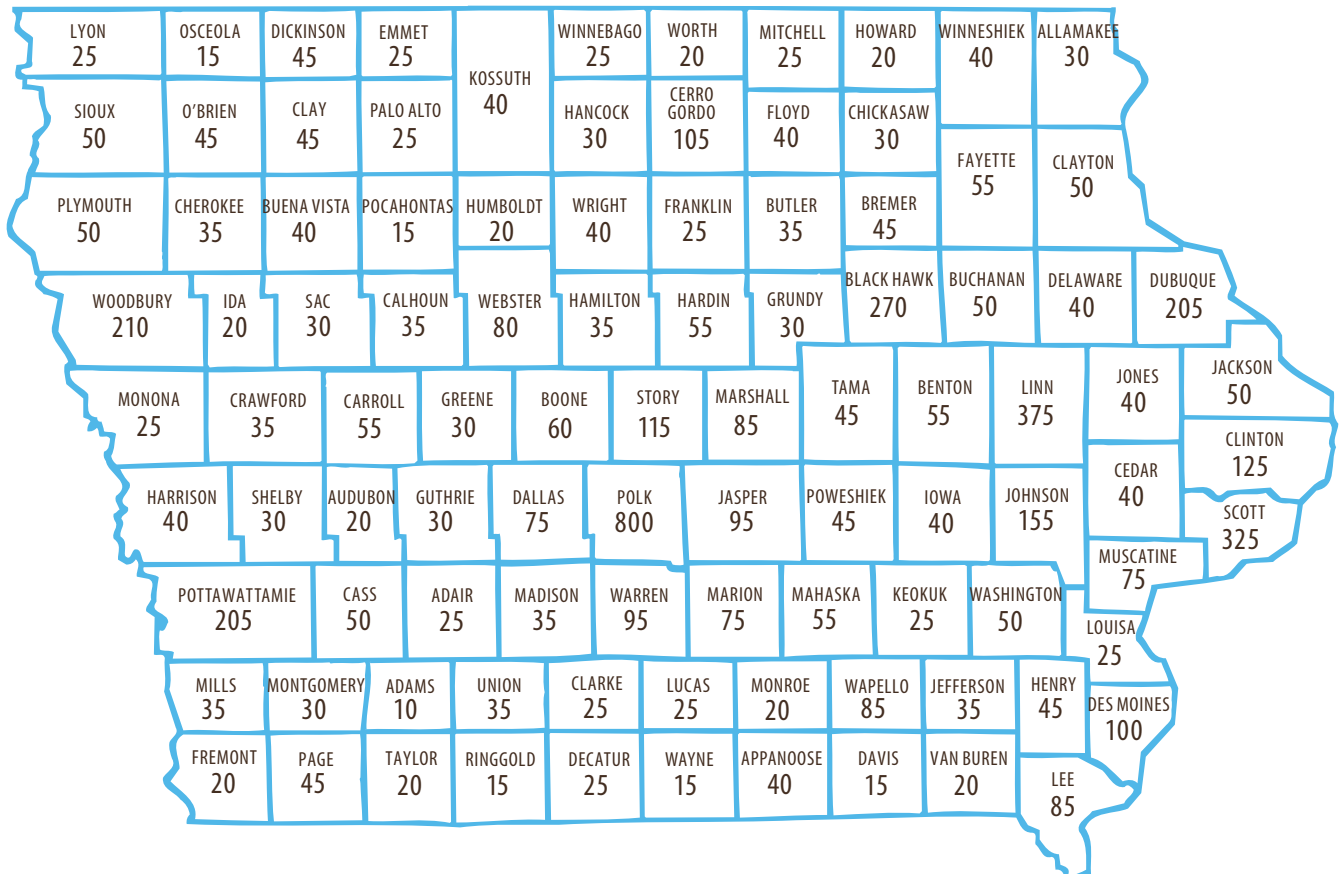
- assemble and report measurements of cancer incidence, survival and mortality among Iowans;
- provide information on changes over time in the extent of disease at diagnosis, therapy, and patient survival;
- promote and conduct studies designed to identify factors relating to cancer etiology, prevention 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 2012

Projected Number of New Cancers in Iowa for 2012



Projected Number of Cancer Deaths in Iowa for 2012



TOP 10 TYPES OF CANCER IN IOWA PROJECTED FOR 2012

New Cancers in Females

Type	# of Cancers	% of Total
Breast	2250	26.5
Lung	1060	12.5
Colon & Rectum	850	10.0
Uterus	600	7.1
Non-Hodgkin Lymphoma	370	4.3
Thyroid	350	4.1
Skin Melanoma	340	4.0
Leukemia	250	2.9
Ovary	240	2.8
Kidney & Renal Pelvis	230	2.7
All Others	1960	23.1
Total	8500	

Cancer Deaths in Females

Type	# of Cancers	% of Total
Lung	750	25.0
Breast	410	13.6
Colon & Rectum	320	10.7
Pancreas	200	6.7
Ovary	180	6.0
Non-Hodgkin Lymphoma	120	4.0
Leukemia	110	3.7
Uterus	100	3.3
Brain	80	2.7
Multiple Myeloma	60	2.0
All Others	670	22.3
Total	3000	

New Cancers in Males

Type	# of Cancers	% of Total
Prostate	2250	25.0
Lung	1300	14.4
Colon & Rectum	850	9.4
Bladder (invasive and noninvasive)	640	7.1
Non-Hodgkin Lymphoma	420	4.7
Skin Melanoma	420	4.7
Kidney & Renal Pelvis	390	4.3
Leukemia	270	3.0
Oral Cavity	250	2.8
Pancreas	240	2.7
All Others	1970	21.9
Total	9000	

Cancer Deaths in Males

Type	# of Cancers	% of Total
Lung	990	29.1
Colon & Rectum	310	9.1
Prostate	300	8.8
Pancreas	200	5.9
Leukemia	150	4.4
Esophagus	140	4.1
Bladder	130	3.8
Non-Hodgkin Lymphoma	130	3.8
Kidney & Renal Pelvis	110	3.3
Brain	100	3.0
All Others	840	24.7
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.

LUNG CANCER

Lung cancer is the leading cause of cancer death in Iowa and in the U.S. In 2012 lung cancer will account for one out of every four cancer deaths.

Between 1973 and 2009, 47,527 males and 25,181 females in Iowa were diagnosed with lung cancer and 37,759 males and 18,896 females died from lung cancer. Among male Iowans, lung cancer has been the leading cause of cancer death for several decades. Among female Iowans, in 1991 lung cancer surpassed breast cancer as their leading cause of cancer death. Age-adjusted rates for male lung cancer incidence and mortality in Iowa were increasing during the 1970s and 1980s, but have been declining since (Figure 1). For females over this same period, these rates have been increasing, although less so since the 1990s, and are expected to begin decreasing during this decade. As a result the male to female ratio of lung cancer incidence has declined from 4.0 to 1 during the 1970s to 1.3 to 1 during the last decade. The explanation for this has been that cigarette smoking was common in men after World War I, but did not become common in women until after World War II. Cigarette smoking rates in men have also

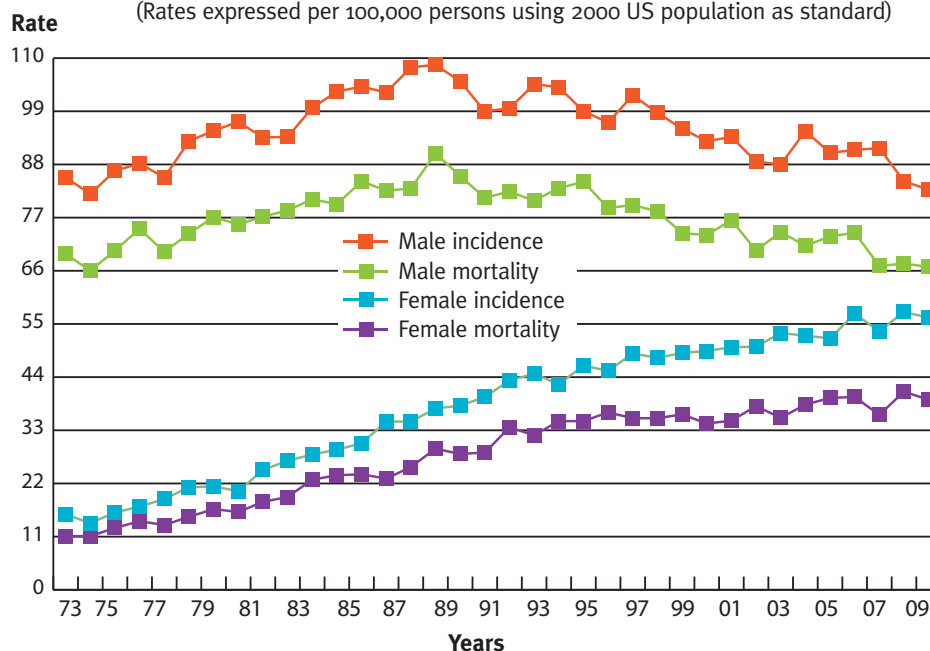
been declining for a longer period of time than in women.

Lung cancer continues to be associated with a relatively low survival (Figure 2). Consequently, incidence and mortality rates mirror one another in both sexes, and mortality rates remain high relative to incidence rates (Figure 1). Five-year relative survival rates for lung cancer in Iowans diagnosed between 1973 and 1981 versus those diagnosed between 1999 and 2006 have increased only slightly, from 12% to 16% in women and from <10% to around 12% in men (Figure 2). This is largely because lung cancer is often initially diagnosed only after it has spread beyond the lungs. A recent clinical trial

involving current and former heavy smokers over the age of 50, screened when using low-dose helical computed tomography (CT) scans versus routine chest X-rays, reported a 20% reduction in lung cancer mortality for those individuals CT screened. Routine chest X-rays in healthy people without symptoms have been shown to be ineffective as a screening test.

The primary means of treatment for lung cancer that cannot be removed surgically has been radiation therapy and/or chemotherapy. This “one treatment fits all” approach is changing. Over the past few years, research into lung cancer has revealed that cancers

Figure 1. Average Annual Lung Cancer Incidence & Mortality Rates in Iowa, 1973 - 2009
(Rates expressed per 100,000 persons using 2000 US population as standard)



that look the same under the microscope can have very different causes at the level of their DNA. Furthermore, specific treatments targeted directly at the specific abnormalities of the DNA in individual lung cancers are showing promise in early clinical trials. As these treatments, tailored specifically toward the genetics of each cancer, are developed further and diffuse more into routine practice, and screening is implemented for heavy smokers who are most vulnerable to developing lung cancer, there is reason to hope for significantly improved survival rates for lung cancer in the Iowa population.

Even with progress in the areas of early detection and therapy, it is vital that we

continue to emphasize that lung cancer is largely a preventable disease. Risk factor reduction remains the primary means to reduce lung cancer incidence and mortality. For over 50 years now, smoking has been identified as the most common cause of lung cancer. In 2012, we project that Iowa will experience 2360 new lung cancer diagnoses. The cause of most of these will be smoking.

Legislation has been a method used by many states to modify tobacco use behavior. On March 16, 2007, Governor Chet Culver signed a bill that raised Iowa's state excise tax on tobacco from \$0.36 to \$1.36 per pack. In the spring of 2008, Iowa lawmakers passed the Smokefree Air Act to protect employees and the general

public. This legislation prohibited smoking in almost all public places and enclosed areas within places of employment, as well as some outdoor areas. Help for smokers who wanted to quit was provided by a dedicated Iowa Quitline (1-800-784-8669; www.quitnow.net/iowa/). These actions have contributed to an appreciable decline in the percent of adults who were current smokers by age group and by gender in the past decade; this decrease was particularly evident among young adults (Figure 3). Despite such successes, in 2010 Iowa still only ranked 20th among the states, with 16.1% of its adult population being current smokers.

Radon is the number one cause of lung cancer among

Figure 2. Lung Cancer 5-year Relative Survival by Gender Iowa, 1973-2006

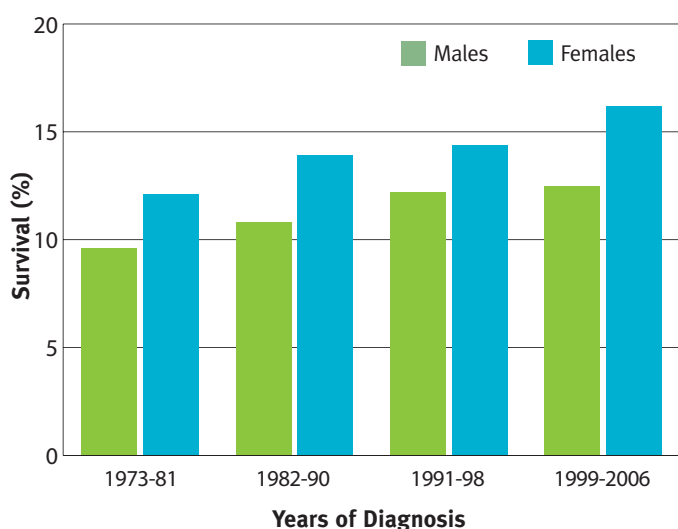
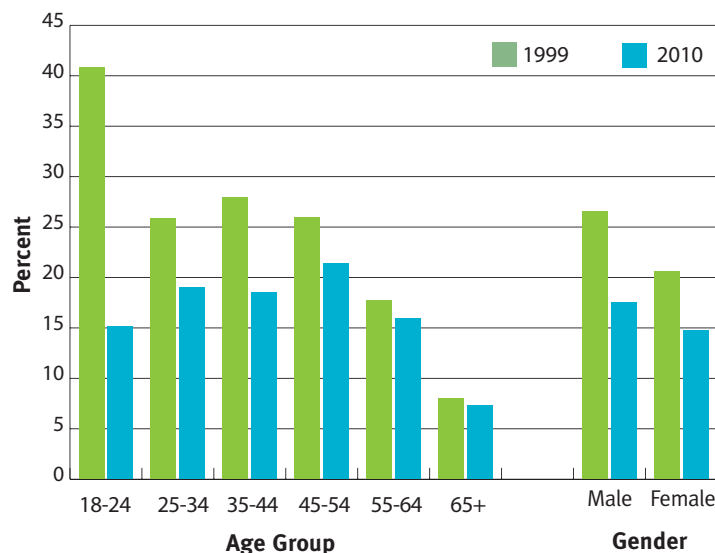


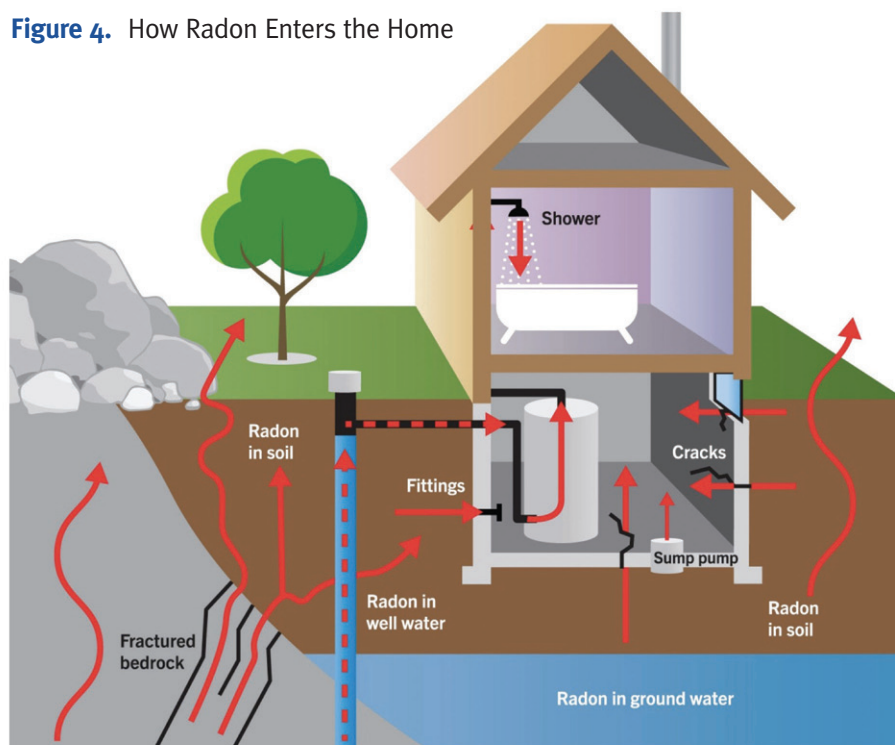
Figure 3. Adults Who Were Current Smokers by Age Group and Gender, Iowa 1999 vs 2010



individuals who have never smoked. Overall, radon is the second leading cause of lung cancer and is responsible for an estimated 21,000 lung cancer deaths each year in the United States, about 400 of which occur among Iowans. Radon is a colorless, odorless, tasteless, radioactive gas produced by the normal decay of uranium found in the soil. Radon typically moves up through the ground and into the air in a home through cracks and other openings in the foundation (Figure 4). Your home traps radon, particularly under closed conditions found when it is cold or hot outside and the furnace and air conditioner, respectively, are working. All 99 counties in Iowa are in the U.S. EPA “red zone” for radon levels, meaning Iowans have a high potential for elevated radon levels in their homes.

In the U.S., radon is measured in picocuries per liter (pCi/L). The EPA recommends indoor levels of radon remain at or below 4.0 pCi/L to decrease the risk of developing radon-induced lung cancer. The average indoor radon concentration in Iowa is 8.5 pCi/L, more than 6 times the national average. Seven out of 10 homes tested in Iowa have radon levels that exceed 4.0 pCi/L.

Figure 4. How Radon Enters the Home



The only way to find out if your home has an elevated radon concentration is to test for it. Do-It-Yourself radon test kits are available, low cost, and easy to perform. You can get these through the mail and in hardware and other retail stores. If radon is detected, the problem can be fixed. Radon reduction systems, also known as mitigation systems, can reduce radon levels in your home by up to 99 percent. Most systems cost between \$1000 and \$2000, depending on your home. Installing a mitigation system at the time of construction is ideal and less costly. However, systems

can be installed in any type of home, even after construction. The Iowa Department of Public Health Radon Program website (<http://www.idph.state.ia.us/eh/radon.asp>) provides a list of licensed radon mitigation professionals. The Iowa Radon Hotline (1-800-383-5992 or <http://www.healthhouse.org>) provides radon information to the public.

RESEARCH PROJECTS DURING 2012

The State Health Registry of Iowa is participating in over five dozen open studies approved by the University of Iowa Human Subjects Office during 2012. 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 20th 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. Plans for a fourth phase of the study were funded and implemented in the fall of 2011. Primary activities for the Iowa Field Staff will be 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 150 publications from this study linked to PubMed are available at the website. The cancer-related references for 2011 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 refunded for its 25th through 29th years. The project

has been extremely productive with over 225 publications, some of which occurred in 2011 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 NCI 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 at the Mayo Clinic 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. These research activities resulted in several publications during 2011. 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 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 Study will involve breast, colorectal, and non-small cell lung cancers in adults diagnosed between January 1, 2010 and December 31, 2010. 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 2011 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 2011, the first manuscript describing this study was published (see last section for listing) with several more reports forthcoming regarding factors related to access to care, treatment and follow-up care, and impact of cancer on physical and psychosocial functioning.

Studies Involving Tissue

Today, researchers are increasingly looking to obtain tissue to study molecular characteristics of cancers. Several studies that involve the SHRI have complemented their subject data with tissue including the Iowa Women's Health Study and the NHL Case-Control Study. In addition, the SHRI is currently involved with several other studies that involve tissue. One of these involves pre-invasive breast cancer and is led by an investigator at Johns Hopkins University. The primary objective of this project is to identify tissue biomarkers of pre-invasive breast cancer that are associated with progression to invasive

breast cancer and are detectable at the time of diagnosis. Such information would be very helpful to health care providers in the clinical management of these patients. The goal for the SHRI is to provide tissue for over 100 case patients and their matched controls. During 2011, 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 2008 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. Currently, we are recruiting more eligible participants to a second phase of this study to enable a genome-wide association study to be conducted to learn more about how genetic, environmental, and lifestyle factors work together to influence whether a woman with breast cancer will develop a second breast cancer in the opposite breast. A listing of publications from the WECARE Study during 2011 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), are creating a database through linkage of information on U.S. transplant recipients (383,444 transplant recipients during 1987-2007), wait list candidates (216,067 candidates during 1987-2007 in addition to those who were subsequently transplanted), and donors (61,430 deceased donors, 57,961 living donors during 1999-2007) with information on cancer from multiple U.S. cancer registries, including the State Health Registry of Iowa. 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 risk factors for cancer among immunosuppressed individuals.

SEER-Medicare

In the early 1990s, the cancer incidence and survival data from the SHRI 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 2011, 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 Public Health Statistics
 - Environmental Health Sciences Research Center
 - Health Effectiveness Research Center
 - Holden Comprehensive Cancer Center
 - Iowa Center for Agricultural Safety and Health
 - Injury Prevention Research Center
 - Preventive Intervention Center
 - Reproductive Molecular Epidemiology Research & Education Program

SELECTED 2011 PUBLICATIONS

AGRICULTURAL HEALTH STUDY

1. Barry KH, Koutros S, Berndt SI, Andreotti G, Hoppin JA, Sandler DP, Burdette LA, Yeager M, Freeman LE, Lubin JH, Ma X, Zheng T, Alavanja MC. Genetic variation in base excision repair pathway genes, pesticide exposure, and prostate cancer risk. *Environ Health Perspect*;119(12):1726-1732, 2011.
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4. Hines CJ, Deddens JA, Coble J, Kamel F, Alavanja MC. Determinants of captan air and dermal exposures among orchard pesticide applicators in the agricultural health study. *Ann Occup Hyg* 2011.
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IOWA WOMEN'S HEALTH STUDY

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3. Bjelakovic G, Gluud C. Vitamin and mineral supplement use in relation to all-cause mortality in the iowa women's health study. *Arch Intern Med*;171(18):1633-1634, 2011.
4. Inoue-Choi M, Flood A, Robien K, Anderson K. Nutrients, food groups, dietary patterns,

and risk of pancreatic cancer in postmenopausal women. *Cancer Epidemiol Biomarkers Prev*;20(4):711-714, 2011.

5. Jang S, Prizment A, Haddad T, Robien K, Lazovich D. Smoking and quality of life among female survivors of breast, colorectal and endometrial cancers in a prospective cohort study. *J Cancer Surviv*;5(2):115-122, 2011.
6. 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.
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NON-HODGKIN LYMPHOMA (NHL) CASE-CONTROL STUDY

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2. Lan Q, Wang SS, Menashe I, Armstrong B, Zhang Y, Hartge P, Purdue MP, Holford TR, Morton LM, Krickler A, Cerhan JR, Grulich A, Cozen W, Zahm SH, Yeager M, Vajdic CM, Schenk M, Leaderer B, Yuenger J, Severson RK, Chatterjee N, Chanock SJ, Zheng T, Rothman N. Genetic variation in Th1/Th2 pathway genes and risk of non-hodgkin lymphoma: A pooled analysis of three population-based case-control studies. *Br J Haematol*;153(3):341-350, 2011.
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