# 2018 Changes: Plans & Progress

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MOSTRA/KCRA Bi-State Regional Meeting, October 2017

# Attribution

This project was supported in part by a cooperative agreement between the Centers for Disease Control and Prevention (CDC) and the Missouri Department of Health and Senior Services (DHSS) (NU58DP006299-01) and a Surveillance Contract between DHSS and the University of Missouri.

# MCR Changes

# MCR Changes

- Require as few of these changes as possible
  - Dependent on NPCR requirements
  - TNM only from CoC facilities
  - Will publish required fields ASAP in 2018

# AJCC Manual
# 8th edition

# Histology

- Verify eligible histology types for each AJCC chapter (October)
  - AJCC, SEER, NPCR team
  - Compared AJCC vs. WHO vs. ICD-O-3
  - To apply to both in situ and invasive behaviors
  - Impact on MP/H rules
- Recommendations reviewed by AJCC experts
- Final decision by chapter authors (June 2017)
- Software and edit changes will follow from decisions

# AJCC New Data Items

- Field lengths expanded from 4 characters - Suffixes for T and N
  - Example: pTis(Paget), pT1(m), cN1(sn)
- Post Therapy T, N, M, group stage
  - Describes tumor burden after neo-adjuvant systemic or RT
  - Defined in AJCC chapters

# ICD-O-3 Histology Revisions

NAACCR Workgroup

# ICD-O-3 Implementation Guidelines

- 54 New terms for current codes
- 24 New codes
- 16 Codes with changes in behavior
- SEER comparing WHO 4th ed. blue books to ICD-O-3
  - Digestive, Breast, Bone, Gyn, Lung, Urinary, CNS, Heme, H&N
- SEER to update site/histology validation list (Nov.)
- May impact reportability if required by NPCR/MCR (Jan.)

# Site-Specific Data Items

NAACCR Workgroup

# Purpose of Work Group

- Evaluate current SSFs & move to discrete data items
  - More flexible
  - Variable code lengths, adds decimal points!
  - Programming
  - Data retrieval
- Recommend: changes, new fields, create new manual for all items
- Harmonize with AJCC and CAP checklists
- Revise: Combine for common schemas and add codes as needed
  - Example: Perineural Invasion – 4 chapters > 1 data item

# 2018 Overview

- Consider:  Relevant?
  - Diagnostic or Prognostic/Required for Stage (AJCC8)?
- Keep only 120 of the 260 data items that were SSFs in CSv2.05
- CS still applicable for older cases, no conversions
- New Items added
- Requirements will vary by standard setter!
- Concerns

# Move SSFs to New Fields

- General coding instructions will be in a separate manual on NAACCR website
- Webinar to explain format and rationale is planned
- Software can be programmed to display only applicable items by site or standard-setter

# Code Changes

- New coding conventions
  - Decimals
  - Values w/o leading zeroes
  - Percentages
  - Ranges
  - Different conventions for Unknown

**Breslow tumor thickness**

| Code | Description |
|---|---|
| **0.0** | No mass/tumor found |
| **0.1-99.9** | 0.1 - 99.9 millimeters<br><br>Examples:<br>0.4 mm – 0.4<br>1.0 mm- 1.0<br>2.5 mm – 2.5<br>2.56 mm- 2.6<br>11 mm – 11.0 |
| **XX.1** | 100 millimeters or larger |
| **XX.2** | Cannot be determined |
| **XX.8** | Not applicable: Information not collected for this schema<br>(If this item is required by your standard setter, use of code XX.8 will result in an edit error) |
| **XX.9** | Not documented in patient record<br>Microinvasion; microscopic focus or foci only and no depth given<br>Breslow Thickness not assessed or unknown if assessed<br>In situ melanoma |

# Changes to Existing SSFs

- Revisions to instructions and codes – to clarify or to harmonize with AJCC and CAP checklists.
- Collapsing of items
  - HER2
    - IHC summary and ISH summary (not every kind of ISH!)
    - IHC codes utilizes both results & interpretation (previously 2 fields)

| | |
|---|---|
| **3** | **Positive (Score 3+)**<br>**Stated as positive** |

# Required Site-Specific Data Items

- Those required for AJCC 8 stage calculation:
  - Esophagus/EGJ Epicenter
  - Mitotic Rate GIST
  - ER, PR and Overall HER2 Summaries
  - Gestational Trophoblastic Prognostic Scoring Index
  - PSA Lab Value, Testis Serum Markers (pre/post orchiectomy)
  - CLL/SLL Anemia, Lymphocytosis, Organomegaly, Thrombocytopenia
  - Mycosis Fungoides Peripheral Blood Involvement,
  - Plasma Cell Myeloma Serum Albumin, Microglobulin, LDH

# Other Site-Specific Data Items

- Prognostic - not required for stage but proposed for collection by some agencies

# Breast SSDIs

## New

| |
|---|
| ER (Estrogen Receptor) Percent Positive or Range |
| ER (Estrogen Receptor) Total Allred Score |
| HER2 IHC Summary |
| HER2 ISH Dual Probe Copy Number |
| HER2 ISH Dual Probe Ratio |
| HER2 ISH Single Copy Number |
| HER2 ISH Summary |
| Oncotype Dx Recurrence Score-DCIS |
| Oncotype Dx Recurrence Score-Invasive |
| Oncotype Dx Risk Level-DCIS |
| Oncotype Dx Risk Level-Invasive |
| PR (Progesterone Receptor) Percent Positive or Range |
| PR (Progesterone Receptor) Total Allred Score |
| ER (Estrogen Receptor) Summary |
| HER2 Overall Summary |
| PR (Progesterone Receptor) Summary |

## Discontinued SSFs

| | |
|---|---|
| 4 | Immunohistochemistry (IHC) of Regional Lymph Nodes |
| 5 | Molecular (MOL) Studies of Regional Lymph Nodes |
| 6 | Size of Tumor-Invasive Component |
| 8 | HER2: Immunohistochemistry (IHC) Lab Value |
| 9 | HER2: Immunohistochemistry (IHC) Test Interpretation |
| 10 | HER2: Fluorescence In Situ Hybridization (FISH) Lab Value |
| 11 | HER2: Fluorescence In Situ Hybridization (FISH) Test Interpretation |
| 12 | HER2: Chromogenic In Situ Hybridization (CISH) Lab Value |
| 13 | HER2: Chromogenic In Situ Hybridization (CISH) Test Interpretation |
| 14 | HER2: Result of Other or Unknown Test |
| 16 | Combinations of ER, PR, and HER2 Results |
| 17 | Circulating Tumor Cells (CTC) and Method of Detection |
| 18 | Disseminated Tumor Cells (DTC) and Method of Detection |
| 19 | Assessment of Positive Ipsilateral Axillary Lymph Nodes |
| 20 | Assessment of Positive Distant Metastases |
| 24 | Paget Disease |

# Changes to Grade

- New Fields & Rules – precedence of AJCC Chapter rules over generic grade definitions  - coding instructions will be provided!
- 3 Fields
  - Grade Clinical
  - Grade Pathologic
  - Grade Post-neoadjuvant

# Grade Example

| G | G Definition |
|---|---|
| 1 | G1: Low combined histologic grade (favorable), SBR score of 3–5 points |
| 2 | G2: Intermediate combined histologic grade (moderately favorable); SBR score of 6–7 points |
| 3 | G3: High combined histologic grade (unfavorable); SBR score of 8–9 points |
| L | Nuclear Grade I (Low) (in situ only) |
| M | Nuclear Grade II (interMediate) (in situ only) |
| H | Nuclear Grade III (High) (in situ only) |
| A | Well differentiated |
| B | Moderately differentiated |
| C | Poorly differentiated |
| D | Undifferentiated, anaplastic |
| 9 | Grade cannot be assessed (GX); Unknown<br>Not applicable |

# Your responsibility

- Be alert to the requirements of your standard setter
- Work with software vendors to customize visible fields
- Determine where these results will be found in your medical records
- Code as precisely as possible, avoid 999
- Support your code choice with TEXT entries

# MPH 2018

SEER

# Multiple Primaries and Histologies

- New name: Solid Tumor Manual
- Format like Heme database, including abstractor notes
- Updated rules – clarifications and updates per WHO changes
  - M5 will not apply to meningioma – bilateral become single primary
- New rules
- November release

# Hematopoietic and Lymphoid Database

- Updates based on
  - AJCC 8th Edition clarifications
  - Revised WHO hematopoietic book
- December release

# SEER Extent of Disease Manual

SEER

# SEER EOD

- Revised for 2018
  - Tumor Size – clinical and pathologic
  - Extent of Primary, Reginal Lymph Nodes and Mets
- Will derive TNM and SEER Summary
- Testing June-July 2018
- Required in SEER states and dual SEER-NPCR states
- Missouri/Kansas not participating in 2018

# SEER Summary 2018

SEER

# SS2018

- Designed to reflect AJCC 8
- Will continue to be direct coded in Missouri/Kansas
- December

# CoC STORE Manual 2018

- New manual format (release Jan. 1, 2018)
- Reflect AJCC 8 changes
- New data items, new codes & FORDS to STORE code conversions

# Radiation Phases

- New Concept: groups of fields broken into “Phases”
- **Phase**

A “phase” consists of one or more consecutive treatments delivered to the same anatomic volume with no change in the treatment technique. Although the majority of courses of radiation therapy are completed in one or two phases (historically, the “regional” and “boost” treatments) there are occasions in which three or more phases are used, most typically with head and neck malignancies.

# COC Items – Radiation

Radiation Treatment Fields within Phases

New Names (old fields convert) for:

Primary volume, Dose per fraction, # Fractions

New Fields for:

- Volume to draining nodes
- Planning technique
- Total dose
- Discontinued early
- Total # phases

# Volume Conversions

| Old Code | New Code | Label |
|---|---|---|
| | **00** | No radiation treatment |
| | **01** | Neck lymph node regions |
| | **02** | Thoracic lymph node regions |
| | **03** | Neck and thoracic lymph node regions |
| | **04** | Breast/ Chestwall lymph node regions |
| | **05** | Abdominal lymph nodes |
| | **06** | Pelvic lymph nodes |
| | **07** | Abdominal and pelvic lymph nodes |
| | **09** | Lymph node region, NOS |
| | | |
| 1 | **10** | Eye/orbit/optic nerve |
| 2 | **11** | Pituitary |
| 3 | **12** | Brain |
| 4 | **13** | Brain (Limited) |
| 40 | **14** | Spinal cord |
| | | |
| | **20** | Nasopharynx |
| | **21** | Oral Cavity |
| | **22** | Oropharynx |
| | **23** | Larynx (glottis) or hypopharynx |
| 8 | **24** | Sinuses/Nasal tract |
| 9 | **25** | Parotid or other salivary glands |
| 50 | **26** | Thyroid |
| 5 | **29** | Head and neck (NOS) |

# Technique & Modality Conversions

## Technique

| FORDS Modality Codes | **StORECode** | **Label** |
|---|---|---|
| 00 | 00 | No radiation treatment |
| 21 | 01 | Low energy x-ray/photon therapy |
| 28 | 02 | 2-D therapy |
| 32 | 03 | Conformal or 3-D conformal therapy |
| 31 | 04 | Intensity modulated therapy |
| 41 | 05 | Stereotactic radiotherapy or radiosurgery, NOS |
| 42 | 06 | Stereotactic radiotherapy or radiosurgery, robotic. |
| 43 | 07 | Stereotactic radiotherapy or radiosurgery, Gamma Knife® |
| | 08 | CT-guided online adaptive therapy |
| | 09 | MR-guided online adaptive therapy |
| 20, 22-27, 29, 30, 40 | 10 | External beam, NOS |
| 80-98 | 11 | Other, NOS |
| 50-62 | 98 | Not Applicable |
| 99 | 99 | Unknown |

## Modality

| FORDS Codes | StORE Code | Definition |
|---|---|---|
| 00 | 00 | No Radiation Treatment |
| 21 | 01 | External beam, photons, low energy |
| 22, 23, 24, 25, 26, 27, 31, 41, 42, 43 | 02 | External beam, photons, megavoltage |
| 40 | 03 | External beam, protons |
| 28 | 04 | External beam, electrons |
| 30 | 05 | External beam, neutrons |
| 20 | 06 | External beam, carbon ions |
| 29 | 09 | External beam, NOS |
| | | |
| 51 | 10 | Brachytherapy, intracavitary, LDR |
| 52 | 11 | Brachytherapy, intracavitary, HDR |
| 53 | 12 | Brachytherapy, Interstitial, LDR |
| 54 | 13 | Brachytherapy, Interstitial, HDR |
| | 14 | Brachytherapy, electronic |
| 50 | 19 | Brachytherapy, NOS |
| | | |
| 55* | 20 | Radioisotopes, Radium-232 |
| 61 | 21 | Radioisotopes, Strontium,-89 |
| 62 | 22 | Radioisotopes, Strontium-90 |
| 55, 60 | 29 | Radioisotopes, NOS |
| | | |
| 98 | 98 | Other, NOS |
| 99 | 99 | Unknown |

# COC Items - LN

New Data Items (Breast & Melanoma only)

- Date of Sentinel Lymph Node Biopsy
- Date Sentinel Lymph Nodes Biopsy Flag
- Sentinel Lymph Nodes Examined
- Sentinel Lymph Nodes Positive
- Date of Regional Lymph Node Dissection
- Date of Regional Lymph Node Dissection Flag

# COC Items - New

Data Submission Type Flag

RQRS vs NCDB Annual Call for Data

(RQRS statement soon – still send in v16, lenient)

Follow Up

- Date of Last Cancer (Tumor) Status
- Date of Last Cancer (Tumor) Status Flag

# NPCR – New Field

- Flag for CoC-accredited facilities
- They will be required to report TNM in 2018
- Software vendor can default code for your facility
- MCR will also ask for your accreditation history (years) and retro-code our database
- Useful for data analysis & consolidation

# NAACCR Standards Volume II

NAACCR

# Volume II

- New and changed data items – many agency specific (Sept.)
- New record layout (Oct.)
- Standard Setter agencies - which data items will be required (Oct.)
- Release Jan. 1, 2018

# Edits v18

NAACCR Workgroup

# v18 Edits Metafile

- EditWriter 5 in .smf format
- Edits developed by Task Forces (Jan.) for:
  - All new data items (EOD, SS18, COC, Prognostic Factors)
  - Update tables with new AJCC 8 values and chapter site/histology pairs
    - Review and adapt current TNM edits to 2018
  - Update tables with changes from ICD-O-3 workgroup
  - Edits for new site-specific data items and relationship to stage

# v18 Edits Metafile

- Basic release by Jan. 1, 2018
- Scheduled updates to add tested edits

# 2018 Implementation Guidelines

NAACCR

# NAACCR Implementation Guidelines 2018

- Depends on timely release of components above
- Projected for March 1, 2018

# Downstream Activities

# Dependent Activities in 2018

- Planned for timely release
- Software updates by vendor programmers
- Education & Training – national and state level
- Central Registry
  - Manuals
  - Required lists
  - Reportability
  - Customized edit sets
  - Consolidation processes

# Be Pro-active

- Software may be delayed
  - Start abstracts in v16 with excellent text to fill in new stage and tx fields later
- Productivity will be slowed as new codes and fields are learned
- Anticipate what you can do during lulls
  - Training, casefinding, follow-up, studies, QC
- Make your managers aware

# Updates

- Watch for announcements from standard setters
  - https://www.naaccr.org/2018-implementation/
- Info MCR receives will be shared in our Monthly Update emails
- Questions?
  - Nancy Rold
  - roldn@missouri.edu
  - 573-882-7236

# Using Missouri Cancer Registry Data

DOES THE QUALITY AND TIMELINESS OF MY DATA MATTER?

YES!


Patient/Public
Cancer/patient information collected at reporting facilities during office visits/procedures
Reporting facilities (hospitals, free-standing treatment centers, physician offices, long-term care facilities & pathology labs) transmit state mandated cancer data to MCR-ARC
Reporting Facilities
Missouri
Local/State Department of Health and Senior Services (DHSS) agencies develop cancer control/public awareness/educational programs for the general population
Local/State Department of Health and Senior Services (DHSS) patient/community educational services
MCR-ARC processes incoming data:
Coding quality
Case matching/
Deduplication
Informs and educates data reporters
Missouri Cancer Registry and Research Center (MCR-ARC)
MCR-ARC submits de-identified data to state/federal agencies for statistical/ research purposes
State/federal agencies compile data to determine cancer incidence/trends in state/federal areas
Department of Health and Senior Services (DHSS)
Center for Disease Control (CDC)
National Program of Cancer Registries (NPCR)
North American Association of Central Cancer Registries
Making Every Incidence Count

# Leadership Team

Project Directors of Grant Component Programs

- NCCCP – National Comprehensive Cancer Control Program
- BCCCP - Breast & Cervical Cancer Control Program
- NPCR – National Program of Cancer Registries

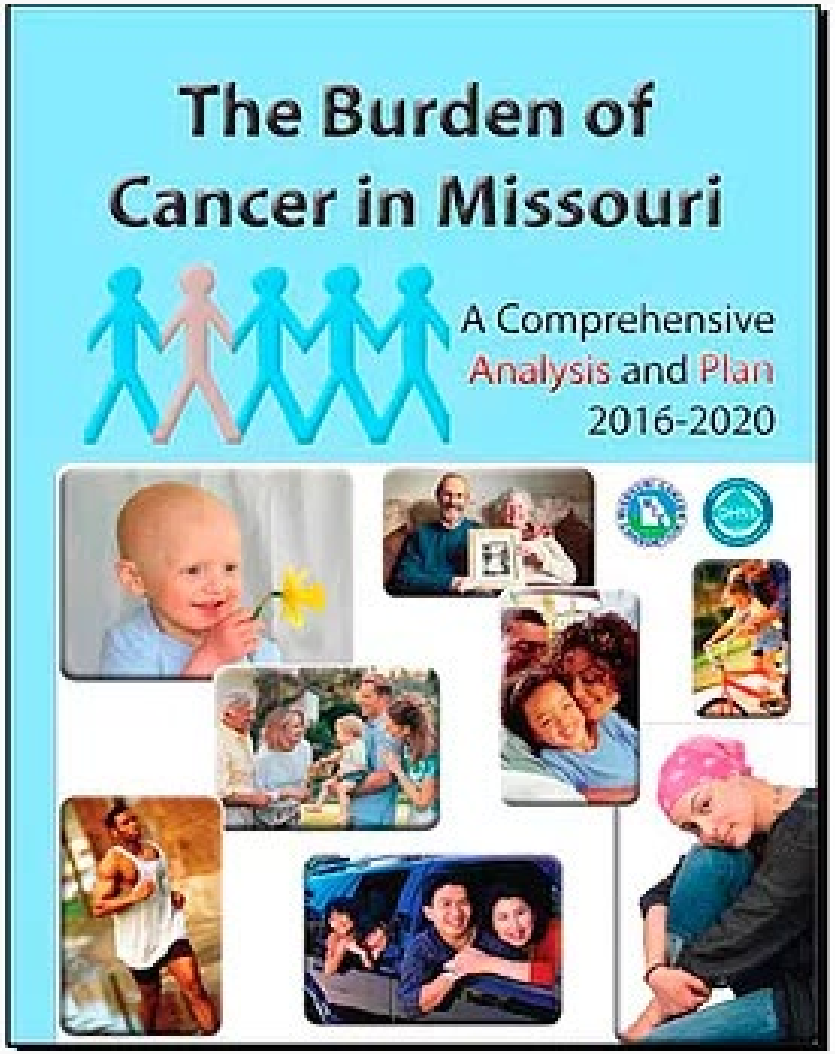
In collaboration with Missouri Cancer Consortium

# Missouri Cancer Consortium

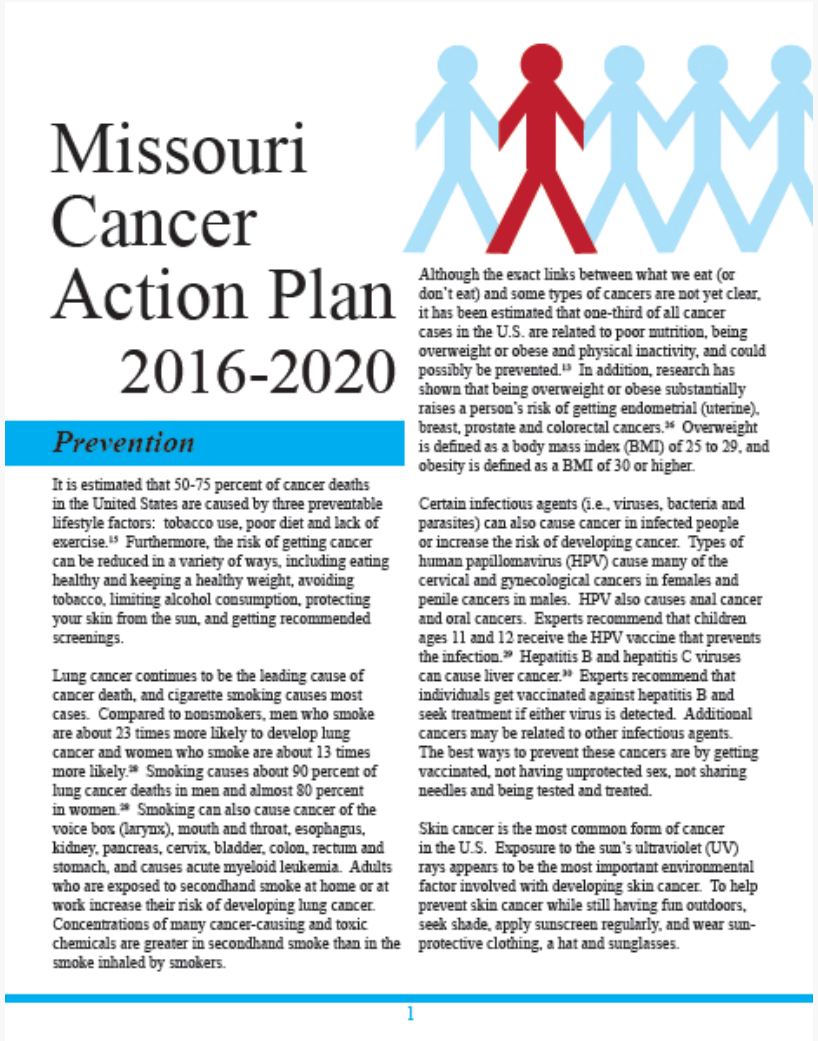
Partners from across the state:

- Cancer Societies, Associations, Coalitions & Alliances
- Hospitals & Providers
- Public Health Workers – State & County
- Academics and Researchers

https://www.cancernmo.org/




http://health.mo.gov/living/healthcondiseases/chronic/chronicdisease/cancerburdenreport2016-2020.pdf



# Missouri Cancer Action Plan 2016-2020

## *Prevention*

It is estimated that 50-75 percent of cancer deaths in the United States are caused by three preventable lifestyle factors: tobacco use, poor diet and lack of exercise.[15] Furthermore, the risk of getting cancer can be reduced in a variety of ways, including eating healthy and keeping a healthy weight, avoiding tobacco, limiting alcohol consumption, protecting your skin from the sun, and getting recommended screenings.

Lung cancer continues to be the leading cause of cancer death, and cigarette smoking causes most cases. Compared to nonsmokers, men who smoke are about 23 times more likely to develop lung cancer and women who smoke are about 13 times more likely.[38] Smoking causes about 90 percent of lung cancer deaths in men and almost 80 percent in women.[38] Smoking can also cause cancer of the voice box (larynx), mouth and throat, esophagus, kidney, pancreas, cervix, bladder, colon, rectum and stomach, and causes acute myeloid leukemia. Adults who are exposed to secondhand smoke at home or at work increase their risk of developing lung cancer. Concentrations of many cancer-causing and toxic chemicals are greater in secondhand smoke than in the smoke inhaled by smokers.

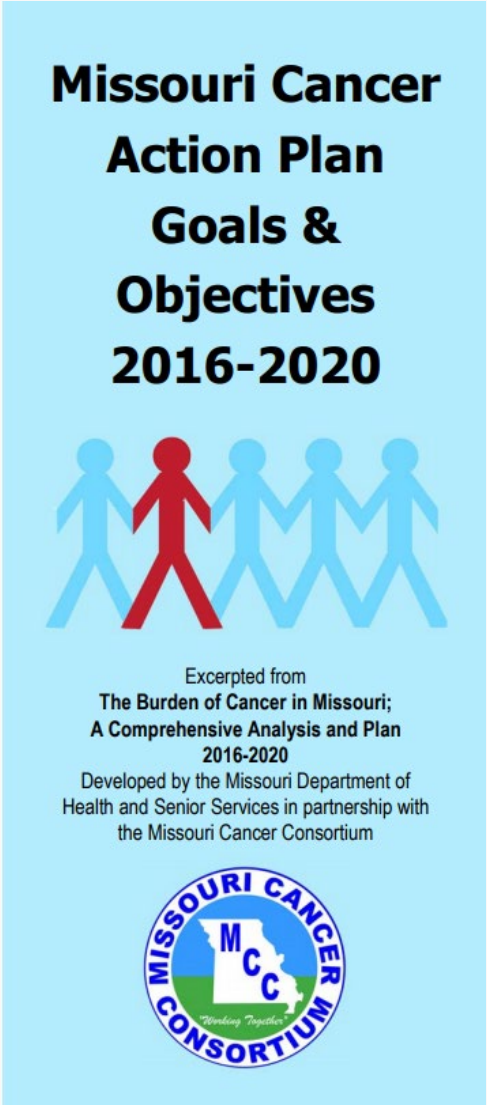
Although the exact links between what we eat (or don't eat) and some types of cancers are not yet clear, it has been estimated that one-third of all cancer cases in the U.S. are related to poor nutrition, being overweight or obese and physical inactivity, and could possibly be prevented.[15] In addition, research has shown that being overweight or obese substantially raises a person's risk of getting endometrial (uterine), breast, prostate and colorectal cancers.[36] Overweight is defined as a body mass index (BMI) of 25 to 29, and obesity is defined as a BMI of 30 or higher.

Certain infectious agents (i.e., viruses, bacteria and parasites) can also cause cancer in infected people or increase the risk of developing cancer. Types of human papillomavirus (HPV) cause many of the cervical and gynecological cancers in females and penile cancers in males. HPV also causes anal cancer and oral cancers. Experts recommend that children ages 11 and 12 receive the HPV vaccine that prevents the infection.[39] Hepatitis B and hepatitis C viruses can cause liver cancer.[39] Experts recommend that individuals get vaccinated against hepatitis B and seek treatment if either virus is detected. Additional cancers may be related to other infectious agents. The best ways to prevent these cancers are by getting vaccinated, not having unprotected sex, not sharing needles and being tested and treated.

Skin cancer is the most common form of cancer in the U.S. Exposure to the sun's ultraviolet (UV) rays appears to be the most important environmental factor involved with developing skin cancer. To help prevent skin cancer while still having fun outdoors, seek shade, apply sunscreen regularly, and wear sun-protective clothing, a hat and sunglasses.

1

http://health.mo.gov/living/healthcondiseases/chronic/chronicdisease/canceractionplan.pdf




https://docs.wixstatic.com/ugd/525482_27777c989f9a4cd2a1e424cb14c820b7.pdf

# Show Me Healthy Women

Breast and Cervical Cancer Control Program at DHSS Links to MCR db

Benefit to them – ascertain stage/tumor info of any diagnosed cancers

Benefit to MCR - potential missed cases among those with positive dx bx

# Age-adjusted Invasive Cancer Incidence Rate : Lung and Bronchus : 2009-2011

**Experimental dashboard with InstantAtlas county cancer profile feature**

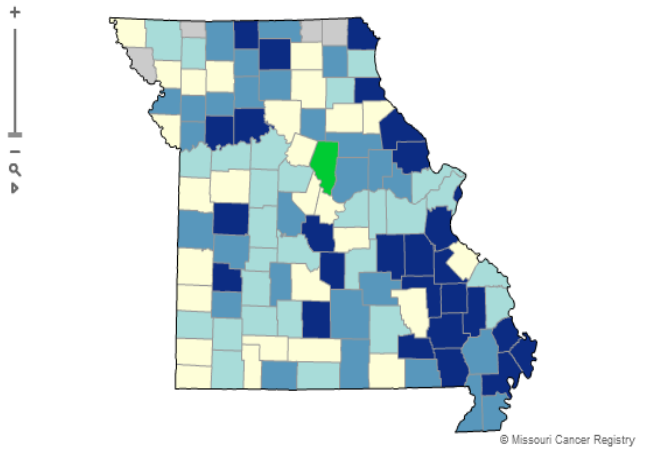
Sources: MCR-ARC 2014DB (Complete 1996-2011 cases); US Combined (2010): 2013 NAACCR Call For Data, December 2012

**Missouri Cancer Registry and Research Center**

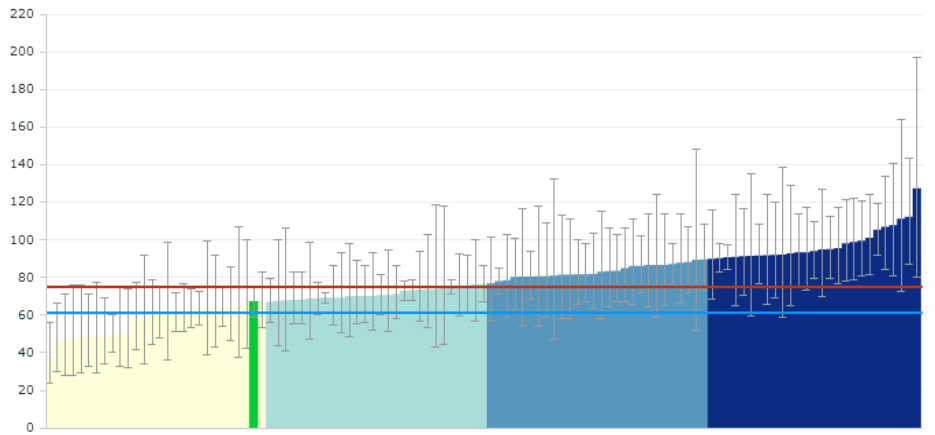
**Select Cancer Site**

- Age-adjusted Invasive Cancer Incidence Rate
  - All Sites
  - Female Breast
  - Cervix
  - Colon and Rectum
  - Corpus and Uterus, NOS
  - Lung and Bronchus
  - Prostate
  - Urinary Bladder

**Select County**




**County Rankings with 95% confidence intervals**




| County | Age-adjusted Rate | Number of Cases |
|---|---|---|
| Adair | 57.5 | 45 |
| Andrew | 45.5 | 29 |
| Atchison | 64.5 | 18 |
| Audrain | 80.1 | 76 |
| Barry | 75.5 | 111 |
| Barton | 49.8 | 26 |
| Bates | 86 | 60 |
| Benton | 69.9 | 80 |
| Bollinger | 91.6 | 44 |
| Boone | 66.7 | 269 |

| State / US | Rate | Cases |
|---|---|---|
| Missouri State | 75 | 15432 |
| US (2010) | 61.6 | -- |

Note: ~ = Rates suppressed if < 16 cases or ^ = Cases suppressed if < 6 cases. Differences not measured if < 16 cases

| Indicator | Period | Rate | Lowest | Selected County Cancer Profile (Major sites) | Highest |
|---|---|---|---|---|---|
| All Sites | 2011 | 459.1 | 162.7 | | 594.2 |
| Female Breast | 2006-2011 | 133.9 | 55.3 | | 186.7 |
| Cervix | 1996-2011 | 5.8 | 5.8 | | 20.8 |
| Colon and Rectum | 2006-2011 | 37.7 | 30.8 | | 69.6 |
| Corpus and Uterus, NOS | 1996-2011 | 27.2 | 12.4 | | 37.2 |
| Lung and Bronchus | 2009-2011 | 66.7 | 37.1 | | 127.1 |
| Prostate | 2006-2011 | 156.6 | 61.6 | | 188.8 |
| Urinary Bladder | 1996-2011 | 18.5 | 8.9 | | 26.7 |

**Legend**

Counties
- 37.1 - 66.8
- 66.9 - 76.3
- 76.4 - 89.4
- 89.5 - 127.1
- ~

**Select Quartile**

Boone

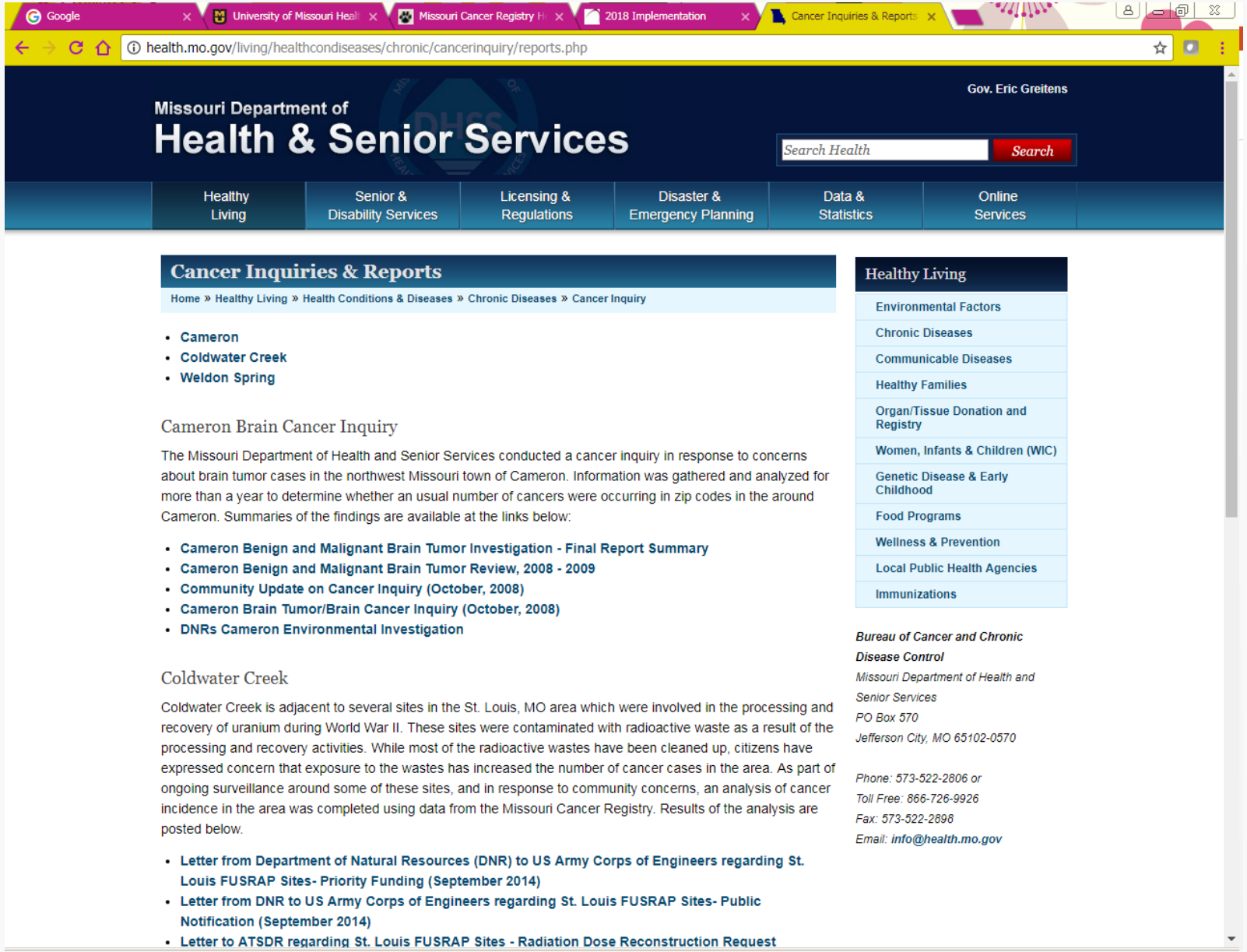
Statistically significant difference from the state rate: higher lower no difference

Missouri state average U.S. Combined (2010)

Quartile 1 Quartiles 2-3 Quartile 4

Help

This project supported in part by cooperative agreement between Centers for Disease Control and Prevention (CDC) and Missouri Department of Health and Senior Services (DHSS) (#U58/DP003924-02) and Surveillance Contract between DHSS and University of Missouri.




http://health.mo.gov/living/healthcondiseases/chronic/cancerinquiry/reports.php

# Data Requests

| | | |
|---|---|---|
| Dept. of Labor/Next of Kin | Requests from patients and families | To document possible energy employee occupational illness and eligibility for compensation |
| DHSS | Site, stage, treatment and zip-code reports | To assess and plan health dept. interventions at state and local level, for cancer inquiries |
| Hospitals | Specialized reports | For accreditation applications, market share analysis, top sites for rural hospitals |
| Researchers | County –level data, specific sites and years | IRB approved research projects – academic, pharmaceutical/military/industry linkages with patient permissions |

# An Ecological Examination of Cancer Screenings, Early Stage Incidence and Mortality in the State of Missouri

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## 1. Background

- In Missouri as in the U.S., colorectal cancer (CRC) and female breast cancer (BC) are two of the leading causes of cancer-related deaths. Missouri's cervical cancer (CC) mortality rates are in the top quartile of rates in the U.S., despite an overall downward trend in mortality.
- In 1992, Missouri began providing free BC and CC screenings to women meeting certain age, income and insurance guidelines. Missouri is also one of the first states to pass laws protecting insurance coverage for the full range of CRC screening exams.
- Population-based evidence regarding impact of the aforementioned screenings and cancer rates in Missouri is lacking.
- Missouri has conducted three surveys similar to the Behavioral Risk Factor Surveillance System (BRFSS) but with much larger sample sizes: the County-Level Study (CLS)

## 2. Purpose

- To examine relationships between prevalence of screenings and early stage incidence and mortality for these three types of screening-amenable cancers in Missouri's 114 counties and the City of St. Louis.

## 3. Methods

- Design: This is an ecological study based on county-specific estimates of selected cancer screening prevalences and early stage cancer incidence and cancer mortality.
- Data:
  - County-specific screening prevalence: Missouri County Level-Studies (CLS) in 2003, 2007 and 2011
  - County-specific early stage (i.e., in situ and localized only) incidence (2004 to 2013): Missouri Cancer Registry (MCR)
  - County-specific cancer deaths (2004 to 2013): Missouri Department of Health and Senior Services death records
- Analysis: Pearson's correlation; Poisson regression
  - SAS survey procedures were used to account for CLS's complex survey design.

## 4. Results

Table 1. Prevalence of cancer screenings in Missouri, Missouri County-Level Study 2003, 2007 and 2011 (N=116,890)

| | All (n, %) | 2003 (n, %) | 2007 (n, %) | 2011 (n, %) |
|---|---|---|---|---|
| **Breast cancer screening** | | | | |
| Ever had CBE | 50753 (93.0) | 5950 (92.9) | 21052 (94.3) | 23750 (91.8) |
| Had CBE in last 2 yrs | 39039 (83.5) | 4844 (86.5) | 16414 (83.6) | 17780 (80.7) |
| Ever had mamm | 50459 (89.5) | 5646 (87.2) | 20686 (91.3) | 24126 (90.1) |
| Had mamm in last 2 yrs | 39064 (82.2) | 4569 (83.5) | 16136 (83.2) | 18358 (80.1) |
| **Cervical cancer screening** | | | | |
| Ever had Pap test | 42918 (96.4) | 4665 (96.7) | 17565 (97.5) | 20688 (95.2) |
| Had Pap test in last 3 yrs | 46279 (82.4) | 6928 (84.9) | 20031 (83.1) | 19319 (79.2) |
| **Colorectal cancer screening** | | | | |
| Ever had FOBT | 29728 (39.43) | 3445 (43.6) | 12670 (41.5) | 13613 (33.9) |
| Had FOBT in last yr | 9397 (38.95) | 1550 (55.2) | 4048 (31.5) | 3799 (28.7) |
| Ever had SoC | 43504 (60.7) | 3601 (51.6) | 17258 (63.4) | 22645 (66.2) |
| Had SoC in last 5 yrs | 33827 (82.2) | 2802 (84.6) | 13776 (84.0) | 17249 (79.0) |

Breast cancer screening age was set as age ≥40 yrs; cervical cancer screening as 21 to 65 yrs; colorectal cancer screening as 50 to 75 yrs. CBE: clinical breast exam; FOBT: fecal occult blood test; mamm: mammogram; SoC: sigmoidoscopy or colonoscopy

Table 2. Correlation estimates of cancer screening prevalence and early stage incidence or mortality in Missouri counties

| | Crude Early Stage Incidence | | Crude Mortality | |
|---|---|---|---|---|
| | Pearson Correlation | | | |
| | r | p | r | p |
| **Breast cancer screening** | | | | |
| Ever had CBE | 0.28 | 0.002 | -0.29 | 0.0016 |
| Had CBE in 2 last 2 yrs | 0.35 | 0.0001 | -0.01 | 0.9 |
| Ever had mamm | 0.28 | 0.002 | -0.01 | 0.9 |
| Had mamm in last 2 yrs | 0.38 | <0.0001 | -0.04 | 0.68 |
| **Cervical cancer screening** | | | | |
| Ever had Pap test | 0.28 | 0.0026 | -0.10 | 0.27 |
| Had Pap test in last 3 yrs | 0.02 | 0.81 | -0.017 | 0.85 |
| **Colorectal cancer screening** | | | | |
| Ever had FOBT | -0.17 | 0.06 | -0.19 | 0.04 |
| Had FOBT in last yr | -0.026 | 0.78 | -0.08 | 0.36 |
| Ever had SoC | -0.23 | 0.01 | -0.38 | <0.0001 |
| Had SoC in last 5 yrs | 0.018 | 0.85 | -0.24 | 0.01 |

See the notes for Table 1. Incidence and mortality rates used the same age ranges as for the screening prevalences.

## 5. Discussion

- This study highlights Pap test's role in CC prevention and control in Missouri.
- It showed a small but significant effect of CBE in detecting BC at early stage and in reducing mortality.
- A statistically significant reduction of CRC mortality associated with FOBT and SoC screenings was observed.
- The findings suggest further incentive to promote population-based screening programs among Missouri residents.

Fig 1. Age-adjusted early stage incidence rates of breast, cervical and colorectal cancer in Missouri, 2004-2013

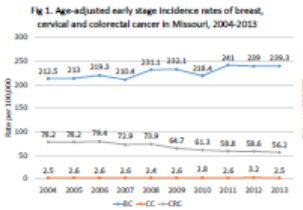
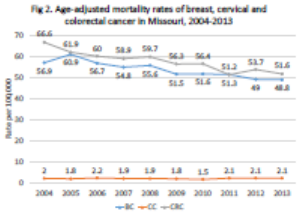



Fig 2. Age-adjusted mortality rates of breast, cervical and colorectal cancer in Missouri, 2004-2013




Breast cancer only included female cases. Early stage included in situ and localized for breast and colorectal cancer; only localized for cervical cancer.

Table 3. Incidence rate ratio and mortality rate ratio of three cancers across levels of cancer screening in Missouri

| | Early stage incidence rate ratio | | | | Mortality rate ratio | | | |
|---|---|---|---|---|---|---|---|---|
| | Unadjusted model | | Adjusted model[1] | | Unadjusted model | | Adjusted model[1] | |
| **Breast Cancer** | | p | | p | | p | | p |
| Ever had CBE | 1.035 (1.021-1.049) | <.0001 | 1.014 (0.998-1.030) | 0.08 | 0.977 (0.963-0.990) | 0.0009 | 0.975 (0.960-0.989) | 0.0007 |
| Had CBE in last 2 yrs | 1.021 (1.011-1.032) | <.0001 | 1.013 (1.006-1.021) | 0.0002 | 1.002 (0.994-1.011) | 0.61 | 0.999 (0.992-1.007) | 0.92 |
| Ever had mamm | 1.023 (1.010-1.039) | 0.004 | 1.008 (1.001-1.016) | 0.03 | 0.999 (0.989-1.011) | 0.97 | 1.003 (0.994-1.012) | 0.52 |
| Had mamm in last 2 yrs | 1.021 (1.017-1.025) | <.0001 | 1.011 (1.008-1.014) | 0.0002 | 1.004 (0.999-1.008) | 0.36 | 1.001 (0.996-1.004) | 0.89 |
| **Cervical cancer** | | | | | | | | |
| Ever had Pap test | 1.033 (0.986-1.083) | 0.17 | 1.076 (1.012-1.114) | 0.01 | 0.923 (0.892-0.988) | 0.02 | 0.964 (0.910-1.026) | 0.24 |
| Had Pap test in last 3 yrs | 0.995 (0.980-1.003) | 0.54 | 1.015 (0.983-1.050) | 0.36 | 0.984 (0.961-1.007) | 0.16 | 0.990 (0.966-1.014) | 0.41 |
| **Colorectal cancer** | | | | | | | | |
| Ever had FOBT | 0.995 (0.991-0.999) | 0.16 | 0.995 (0.992-0.998) | 0.10 | 0.994 (0.986-1.001) | 0.13 | 0.996 (0.992-1.000) | 0.04 |
| Had FOBT last yr | 1.004 (1.000-1.010) | 0.06 | 1.001 (0.997-1.006) | 0.57 | 1.004 (0.995-1.013) | 0.39 | 0.999 (0.996-1.003) | 0.64 |
| Ever had SoC | 0.996 (0.990-1.004) | 0.33 | 0.992 (0.985-1.000) | 0.04 | 0.988 (0.984-0.992) | <.0001 | 0.992 (0.987-0.996) | 0.009 |
| Had SoC in last 5 yrs | 1.005 (0.993-1.018) | 0.37 | 1.007 (0.997-1.018) | 0.18 | 0.988 (0.981-0.996) | 0.002 | 0.998 (0.991-1.004) | 0.49 |

[1] Poisson regression rate ratio estimates (IRR and MRR) adjusted for county-level covariates including mean age, % whites, % with low income, % with less than high school, % without insurance coverage, % attempted to access care but could not get it.

The Missouri Cancer Registry and Research Center (MCR-ARC) is supported in part by a cooperative agreement between the Centers for Disease Control and Prevention (CDC) and the Missouri Department of Health and Senior Services (DHSS) (5NU58DP003924-05) and a Surveillance Contract between DHSS and the University of Missouri (MU).

For more information about this project, contact: Yilin Yoshida, PhD, Postdoctoral Fellow, MCR-ARC, Health Management & Informatics yoshiday@health.Missouri.edu

The authors would like to thank MCR-ARC Quality Assurance staff and the staff of facilities throughout MO and other states' central cancer registries for their dedication in continuous quality improvement and submitting their reportable cases to MCR-ARC; and to the MO-DHSS, particularly to Shumei Yun, MD and Sherry Homan, PhD for access to mortality & CLS data.

# Student to the Rescue: Creating a Profile of Female Breast Cancer for Missouri State Senate District #19

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## BACKGROUND

- Breast cancer is the most common cancer in the United States, other than skin cancer.
- Over 12 % of women will be diagnosed with breast cancer during their lifetime.
- Missouri cancer incidence and mortality rates are displayed in tables on the Missouri Department of Health & Senior Services website by geographic area (state, region and county), by stage at diagnosis and by demographic characteristics (age, race, etc.) and in similar visual displays on the Missouri Cancer Registry and Research Center (MCR-ARC) website.
- Given that breast cancer incidence and mortality vary by race, stage at diagnosis and geographic region, MCR-ARC wanted to produce data that would be of interest to lawmakers as well as public health officials but no staff were available to create the fact sheets unless this task could be assigned to a graduate student.

## PURPOSE

To create a profile for female breast cancer for Missouri State Senate districts, beginning with District # 19, and compare the district profile to the Missouri female breast cancer profile.

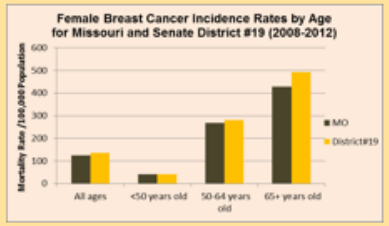
## METHODS

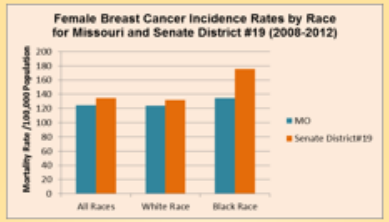
- We linked our female breast cancer data to the SSDI and NDI data to obtain complete survival information through 2011.
- Cases in counties split by senate districts were geocoded to determine their district for incidence and survival data; mortality data from NCHS was only available at the county level.
- Population data at the district, age, race, and year level was created by combining Census ACS and PEP data.
- A specific database was created by MCR-ARC's Senior Statistician and loaded into a statistical software package developed for the SEER program to analyze cancer data.
- We calculated Missouri female breast cancer incidence and mortality rates for the period from 01/01/2008 to 12/31/2012 and survival for 01/01/2004 to 12/31/2010 using SEER*Stat software.
- The calculated rates were by age, race, breast cancer stage, and district.
- We used the Census Bureau's Cartographic Boundary Files to create maps of Missouri Senate Districts.
- We uploaded our results along with the cartographic files to the InstantAtlas Desktop and created interactive mapping reports that displayed female breast cancer incidence, survival, and mortality rates by Missouri State Senate District.
- We will attach our interactive mapping reports to MCR-ARC's website.
- The interactive reports will include maps, graphs, and tables for the 34 Missouri State Senate Districts.

## RESULTS

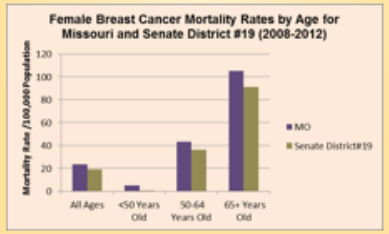
Incidence, mortality and survival rates were measured for each of the 34 Missouri State Senate districts. Here, we present the female breast cancer profile for District #19, which includes Boone and Cooper counties, and compare the results to Missouri rates.

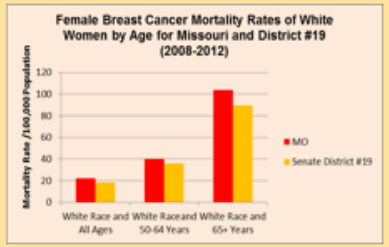
**Female Breast Cancer Incidence Rates by Race and Age:**



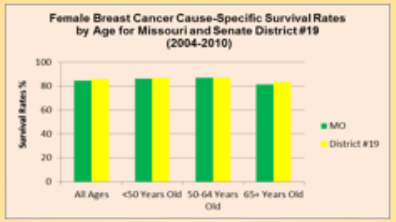



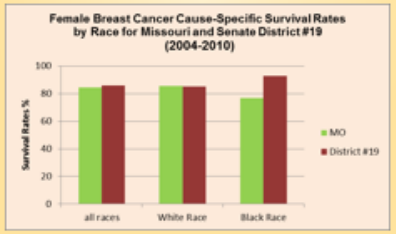

**Female Breast Cancer Mortality Rates by Race and Age:**

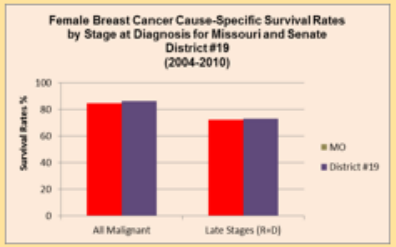



**Female Breast Cancer 5-Year Cause-Specific Survival Rates:**




## SUMMARY

**Incidence:**

- For all races and ages, District #19's incidence rate was higher than Missouri's rate.
- Women >50 years old have a higher incidence rate than women <50 years old in both District #19 and the state.
- For District #19, the incidence rate among women >50 years old was higher than the state's rate for the same age group.
- The incidence rate was higher among black women for both the state and the district.
- Among black women, the incidence rate was higher for the district than the entire state.

**Mortality:**

- For all races and ages, the district's mortality rate was lower than the state rate.
- The mortality rate for women >50 years old was lower than Missouri's mortality rate for the same age group.
- Among white women, the district's mortality rates were lower than Missouri rate for all age groups.
- The mortality rates for blacks could not be reported because there were fewer than 10 cases.

**Survival:**

- For all races and ages, the district's cause-specific survival rates were equal or a slightly higher than Missouri's rates.
- For women <50 years old, the district survival rate was higher than the state's rate.
- For women >50 years old, Missouri survival rates were almost equal or lower than the district's rates.
- Among white females, the district's rate was equal to the Missouri survival rate for the same race.
- Among black females, Missouri's survival rate was lower than the district's survival rate.
- For District #19, the survival rate among black women was higher than the survival rate among white women.
- For all disease stages, the district's survival rate was higher than the Missouri survival rate.

## CONCLUSION

- Overall, while the incidence of breast cancer is relatively high compared to the state, the mortality and survival outcomes are good.
- Very informative for decision makers and public health practitioners.
- Easily accessible and understood by women with breast cancer, family members/friends and the general public.
- The profile might be used to explore effectiveness of current breast cancer initiatives and interventions at the district level.
- The results could be used to study impact of coverage and accessibility to screening and health care services.
- Linking the profile to GIS reports might be used to explore issues related to social inequality in District #19.

MCR data collection activities are supported in part by a cooperative agreement between the Centers for Disease Control and Prevention (CDC) and the Missouri Department of Health and Senior Services (DHSS) (5U58DP003934-04) and a Surveillance Contract between DHSS and the University of Missouri (MU).

Mizzou

# Estimated Female Breast Cancer Mortality-to-Incidence Ratio (MIR) of the Counties and Senatorial Districts Grouped to County Boundaries (SDGCs) in Missouri, 2008 - 2012

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## BACKGROUND

- Mortality-to-Incidence Rations (MIRs) could expand the understanding of the demographic, environmental, and social factors which might lead to unexpected changes of mortality rates relative to incidence rates.
- MIRs could offer an influential method to explore cancer magnitude and prognosis.
- The MIR might help in exploring and addressing hidden differences in cancer consequences by area, age, and race.

## STUDY AIMS

- To measure MIRs on Missouri senatorial districts grouped to county boundaries (SDGCs).
- To explore female breast cancer (FBC) racial and age disparities in Missouri.

## METHODS

- MIRs by age and race for FBC cases were calculated by dividing age-adjusted FBC mortality rates by age-adjusted FBC incidence rates for the 20 SDGCs for the period from 2008 through 2012.
- We calculated approximate 95% confidence intervals (CIs) of the MIRs:
  1. Normal approximation to the log of the ratios using the delta method for the variance.
  2. Transformed the log-scale CIs back to the original scale.
- Results were measured per the 20 SDGCs, as Table 1 shows.

**Table 1. Senate districts grouped to county boundaries (SDGCs) and their corresponding Senate District(s)**

| *SDGCs #* | *Senate Districts (SD) (N = 34) per SDGC* |
|---|---|
| SDGC #1 | SD #6 |
| SDGC #2 | SD #10 |
| SDGC #3 | SD #16 |
| SDGC #4 | SD #18 |
| SDGC #5 | SD #19 |
| SDGC #6 | SD #21 |
| SDGC #7 | SD #25 |
| SDGC #8 | SD #27 |
| SDGC #9 | SD #28 |
| SDGC #10 | SD #29 |
| SDGC #11 | SD #31 |
| SDGC #12 | SD #32 |
| SDGC #13 | SD #33 |
| SDGC #14 | SD #34 |
| SDGC #15 | SD #s: 01,04,05,13,14,15,24,26 (Franklin, St. Louis City, St. Louis County) |
| SDGC #16 | SD #s: 02,23 (St. Charles County) |
| SDGC #17 | SD #s: 03,22 (6 counties south of St. Louis) |
| SDGC #18 | SD #s: 07,08,09,11 (Jackson County) |
| SDGC #19 | SD #s: 12,17 (15 Counties in northwest Missouri) |
| SDGC #20 | SD #s: 20,30 (Christian & Greene Counties) |

## RESULTS

FBC MIR results were presented in tables and visualized using InstantAtlas software to show the ratios by age group (Table 2) and race (Table 3) for each SDGC.

**Table 2. FBC MIRs by age, 2008-2012**

| | < 50 | | | 50-64 | | | ≥ 65 | | |
|---|---|---|---|---|---|---|---|---|---|
| SDGC | MIR | 95% CI LL | 95% CI UL | MIR | 95% CI LL | 95% CI UL | MIR | 95% CI LL | 95% CI UL |
| Missouri | 0.12 | 0.11 | 0.13 | 0.17 | 0.12 | 0.15 | 0.26 | 0.16 | 0.24 |
| #1 | 0.17 | 0.10 | 0.27 | 0.24 | 0.17 | 0.12 | 0.31 | 0.17 | 0.19 |
| #2 | 0.10 | 0.05 | 0.18 | 0.21 | 0.10 | 0.10 | 0.26 | 0.14 | 0.15 |
| #3 | 0.14 | 0.08 | 0.25 | 0.25 | 0.14 | 0.12 | 0.35 | 0.18 | 0.21 |
| #4 | 0.17 | 0.10 | 0.28 | 0.22 | 0.17 | 0.11 | 0.32 | 0.15 | 0.20 |
| #5 | ^ | ^ | ^ | 0.19 | ^ | 0.09 | 0.25 | 0.13 | 0.14 |
| #6 | 0.20 | 0.14 | 0.35 | 0.26 | 0.22 | 0.13 | 0.35 | 0.18 | 0.21 |
| #7 | 0.12 | 0.07 | 0.22 | 0.23 | 0.12 | 0.18 | 0.37 | 0.24 | 0.23 |
| #8 | 0.11 | 0.06 | 0.20 | 0.28 | 0.11 | 0.14 | 0.37 | 0.20 | 0.22 |
| #9 | 0.16 | 0.09 | 0.28 | 0.27 | 0.16 | 0.15 | 0.33 | 0.20 | 0.21 |
| #10 | ^ | ^ | ^ | 0.21 | ^ | 0.09 | 0.29 | 0.14 | 0.18 |
| #11 | 0.14 | 0.08 | 0.23 | 0.20 | 0.14 | 0.09 | 0.38 | 0.14 | 0.24 |
| #12 | 0.16 | 0.09 | 0.27 | 0.27 | 0.16 | 0.13 | 0.37 | 0.19 | 0.22 |
| #13 | ^ | ^ | ^ | 0.30 | ^ | 0.15 | 0.41 | 0.21 | 0.25 |
| #14 | 0.09 | 0.05 | 0.16 | 0.20 | 0.09 | 0.10 | 0.31 | 0.14 | 0.18 |
| #15 | 0.10 | 0.06 | 0.12 | 0.17 | 0.10 | 0.14 | 0.24 | 0.15 | 0.20 |
| #16 | 0.10 | 0.07 | 0.15 | 0.16 | 0.10 | 0.10 | 0.27 | 0.13 | 0.18 |
| #17 | 0.12 | 0.08 | 0.18 | 0.19 | 0.12 | 0.11 | 0.36 | 0.14 | 0.25 |
| #18 | 0.16 | 0.13 | 0.21 | 0.23 | 0.16 | 0.16 | 0.28 | 0.19 | 0.21 |
| #19 | 0.08 | 0.05 | 0.12 | 0.19 | 0.08 | 0.11 | 0.32 | 0.15 | 0.22 |
| #20 | 0.12 | 0.08 | 0.18 | 0.19 | 0.12 | 0.11 | 0.27 | 0.15 | 0.19 |

**Table 3. FBC MIRs by race, 2008-2012**

| | White | | | Black | | |
|---|---|---|---|---|---|---|
| SDGC | MIR | 95% CI LL | 95% CI UL | MIR | 95% CI LL | 95% CI UL |
| Missouri | 0.18 | 0.17 | 0.19 | 0.35 | 0.23 | 0.27 |
| #1 | 0.19 | 0.16 | 0.24 | ^ | ^ | ^ |
| #2 | 0.16 | 0.13 | 0.20 | ^ | ^ | ^ |
| #3 | 0.21 | 0.17 | 0.25 | ^ | ^ | ^ |
| #4 | 0.19 | 0.16 | 0.23 | ^ | ^ | ^ |
| #5 | 0.14 | 0.11 | 0.18 | ^ | ^ | ^ |
| #6 | 0.22 | 0.18 | 0.27 | ^ | ^ | ^ |
| #7 | 0.22 | 0.18 | 0.27 | 0.35 | 0.19 | 0.65 |
| #8 | 0.20 | 0.17 | 0.25 | ^ | ^ | ^ |
| #9 | 0.22 | 0.18 | 0.26 | ^ | ^ | ^ |
| #10 | 0.17 | 0.14 | 0.21 | ^ | ^ | ^ |
| #11 | 0.21 | 0.17 | 0.25 | ^ | ^ | ^ |
| #12 | 0.23 | 0.19 | 0.28 | ^ | ^ | ^ |
| #13 | 0.24 | 0.20 | 0.29 | ^ | ^ | ^ |
| #14 | 0.17 | 0.13 | 0.20 | ^ | ^ | ^ |
| #15 | 0.15 | 0.14 | 0.16 | 0.34 | 0.21 | 0.27 |
| #16 | 0.16 | 0.14 | 0.19 | ^ | ^ | ^ |
| #17 | 0.20 | 0.18 | 0.24 | ^ | ^ | ^ |
| #18 | 0.19 | 0.17 | 0.21 | 0.36 | 0.21 | 0.31 |
| #19 | 0.18 | 0.16 | 0.21 | ^ | ^ | ^ |
| #20 | 0.17 | 0.15 | 0.20 | ^ | ^ | ^ |

^: Suppressed due to small counts.

**Figure 1. Area profile mapping report of 65+ female breast cancer (FBC) incidence rates by senate districts grouped to county boundaries (SDGCs) in Missouri, 2008-2012**

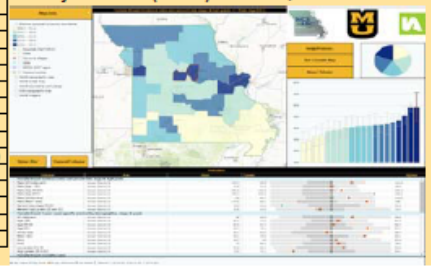


**Figure 2. Area profile mapping report of female breast cancer (FBC) mortality rates of white females by senate districts grouped to county Boundaries (SDGCs) in Missouri, 2008-2012**

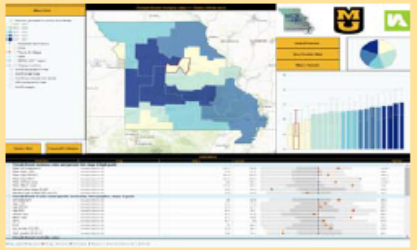
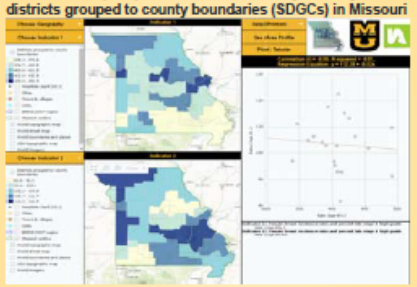


**Figure 3. Double map InstantAtlas report of 65+ female breast cancer (FBC) incidence and mortality rates by senate districts grouped to county boundaries (SDGCs) in Missouri**



## DISCUSSION

- There are no previous efforts at MCR-ARC to assess MIR ratios among FBC cases by age and race in Missouri.
- By measuring these ratios, we could extend our understanding of the destiny of the diagnosed FBC cases.
- MIR results based on geographical limits could show inequalities and disparities in distribution of cancer based on race and age.
- Significantly high MIRs among the 65+ FBC cases, in comparison to the two younger age groups, might be interpreted as:
  - Comorbidities might limit management decisions such as exposure to strong chemotherapy courses with or without radiotherapy.
  - The death from causes other than breast cancer of the FBC cases might be missed by the death certificate writers to be attributed to the breast cancer.
  - The highest MIRs for the 65+ FBC cases were for rural Missouri. This could be attributed to a variety of factors such as lack of accessibility to appropriate oncology services, lack of treatment follow-up and compliance, poverty, and Medicare copayments.
- MIRs were higher among black females than white females.
- There were huge spatial rural-urban inequalities for the 65 and older FBC cases discovered by the current study. Higher MIRs were found for rural SDGCs than urban and metropolitan SDGCs. These findings could be attributed to:
  - Poverty, lack of coverage, and inaccessibility to available diagnostic and treatment options due to limited eligibility to Medicaid services for the poor and rural at-risk population.
- Despite Medicare coverage of 65+ year-old females across Missouri, the highest MIRs for the 65+ year-old FBC cases were for the rural Missouri. This could be attributed to:
  - Lack of accessibility of rural FBC cases to appropriate oncology services, lack of treatment follow-up and compliance, poverty, and Medicare copayment requirements.

## CONCLUSIONS

- MIRs afford a distinctive measure of cancer inequalities which consider two very important measures, mortality and incidence rates.
- MIRs could be used to estimate the fatality of FBC and to explore FBC age and racial disparities by area.
- MIR ratios might help policy makers and intervention designers tackle FBC effectively and efficiently in Missouri.
- Missouri has many rural areas with low education levels and high rates of poverty. We need to explore all possible risk factors in addition to considering poverty and unequal distribution of resources among Missouri's population.

## AKNOWLEDGMENT

MCR data collection activities are supported in part by a cooperative agreement between the Centers for Disease Control and Prevention (CDC) and the Missouri Department of Health and Senior Services (DHSS) (#U58/DP003924-05) and a Surveillance Contract between DHSS and the University of Missouri. We want to thank reporting facility staff for their ongoing efforts to report new cancer cases to MCR.

## CONTACT INFORMATION

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Mizzou

# Spatio-temporal Investigation of Colorectal Cancer Incidence and Mortality Rates in Missouri

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## Background

In the US, colorectal cancer (CRC) is the **3rd** most common cancer in both men and women and the **2nd** leading cause of cancer-related deaths.

- Among people **over 50** years old, CRC incidence and mortality rates have been **declining**;
- Among **younger** people in the US, the incidence rates have been **increasing**;
- Missouri ranked in the **top quartile** for incidence rates in 2012.

## Objective

To examine Missouri's CRC incidence and mortality rates patterns and trends more closely with an emphasis on the trends by gender & age, using data from the Missouri Cancer Registry.

## Methods: Data & Notations

A spatio-temporal statistical model will be used to analyze the CRC incidence and mortality rates. The analysis is limited to malignant cases only, with known age and sex, from 1998 to 2012. The county at diagnosis is available to study spatial associations.

We have 2 (incidence & mortality) data types, 2 (males & females) genders, 4 (<40, 40-49, 50-64, 65+) age groups, which gives us 16 response variables to study the spatial patterns among 115 counties and time trends along 5 (15 years with 3 years combined) times periods.

For each response variable:

- $y_{it}$: number of CRC incidence(mortality) cases in county $i = 1, ..., 115$, during time period $t = 1, ..., 5$;
- $n_{it}$: the corresponding population for $y_{it}$.
- $p_{it}$: the corresponding probability for new cases (deaths).

## Methods: Models

A Bayesian Poisson regression framework for each specified response varaible:

**First stage:**

$$\begin{aligned} y_{it} &\sim Poisson(n_{it}p_{it}) \\ \log(p_{it}) &= Z_{it} + e_{it}, \quad e_{it} \overset{iid}{\sim} N(0, \delta_0) \end{aligned}$$

**Second stage:**

$$\begin{aligned} Z_{it} &= \beta + \theta s_t + \gamma_i, \\ [\delta_0] &\propto \frac{1}{\delta_0}, \end{aligned}$$

where $\gamma_i$ is the spatial effect, $\beta$ is the intercept, $\theta$ is the slope with time effect , and $s_t$ is the time covariate standardized from 1 to 5. Both $\beta$ and $\theta$ follow flat normal priors. The vector $\mathbf{\Gamma} = (\gamma_1, ..., \gamma_I)'$ is given a proper CAR prior

$$\mathbf{\Gamma} \sim N(\mu, \delta B^{-1}),$$

with

$$B = I - \rho C,$$

where $C$ is the adjacency matrix to describe the neighborhood structure for counties in MO.

**Third stage:**

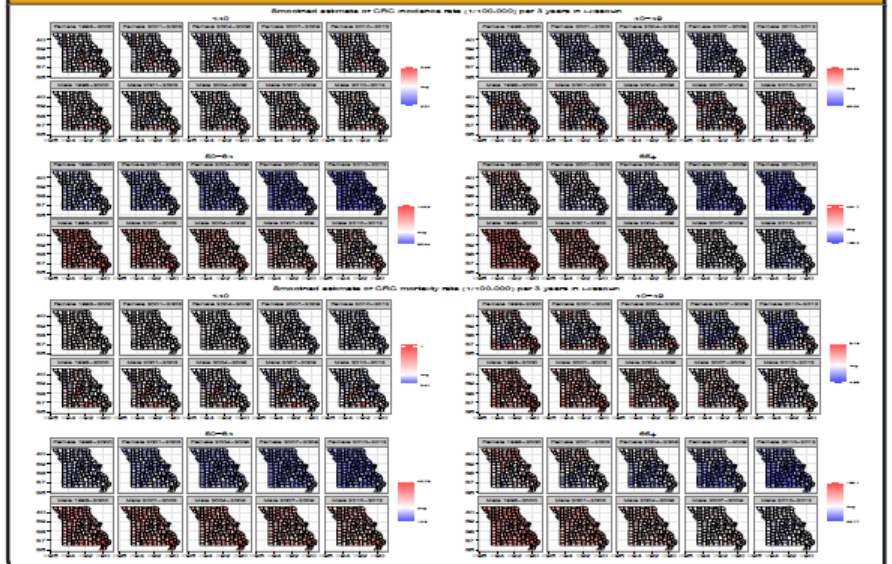
$$\begin{aligned} \rho &\sim Unif(0, \lambda_I^{-1}), \\ \delta &= \frac{\delta_0}{\eta}, \\ [\eta|a] &= \frac{a}{(a+\eta)^2}, \quad \eta > 0, \end{aligned}$$

where $\lambda_I$ is the largest eigenvalue of $B$.

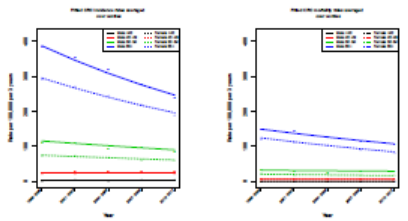
## Methods: Model Selection

Different models were built based on if the slope parameters for people <50 should be 0 or if males and females should share the same intercept within each age group. **DIC** (deviance information criterion) is used for model selection. The model with smaller DIC is preferred. The model selection results suggested the model with no time trends for incidence rate for people <50, while the one with time trend for the mortality rates. The models with no gender differences in rates for people <50 was selected.

## Results: Spatio-temporal Smoothing



## Results: Time Trends



## Conclusions

- For people 50+, the incidence and mortality declined over time and men have higher rates than women.
- There were strong spatial correlations for people 65+ while a much weaker one for people 50-64.
- For people <50 years old, there was no significant trend in the incidence rates but a slightly decreasing trend for the mortality rates.The difference between genders was not significant in these younger age-groups and there were no significant spatial correlations.

## Contact

For more information about this project, contact: **Jiang Du**, jdx66@mail.missouri.edu

The Missouri Cancer Registry and Research Center (MCR-ARC) is supported in part by a cooperative agreement between the Centers for Disease Control and Prevention (CDC) and the Missouri Department of Health and Senior Services (DHSS) (5NU58DP003924-04) and a Surveillance Contract between DHSS and the University of Missouri (MU).


Patterns and recent trends in mastectomy and breast conserving surgery for women with early-stage breast tumors in Missouri
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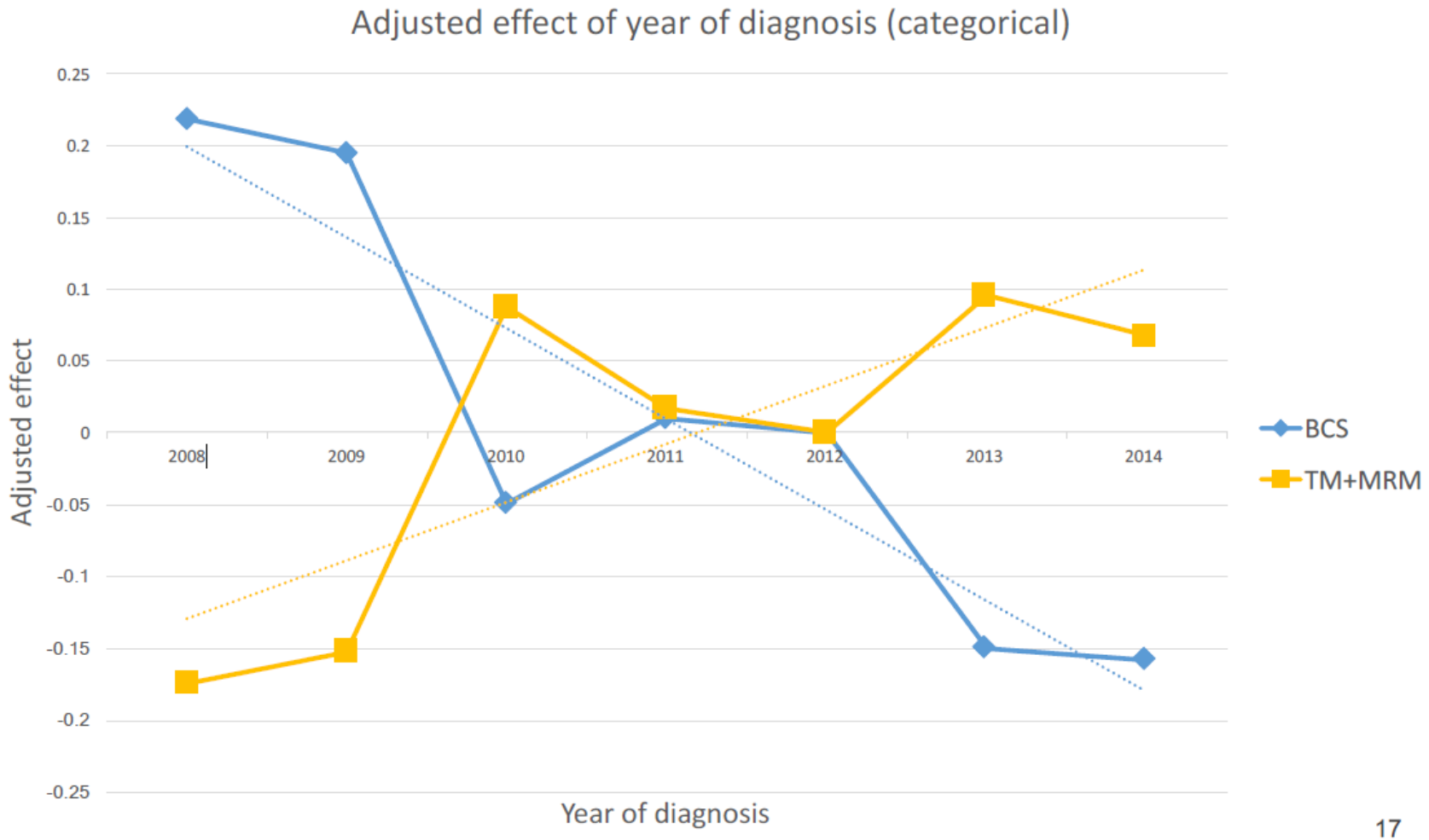
Missouri Cancer Registry and Research Center
Department of Health Management and Informatics
University of Missouri, School of Medicine

# Results – year effects:
## BCS vs Total + MRM

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# Results – summary

- Time trends
  - The percentage of cases receiving **BCS** had **decreased**
    - Controlling for the selected demographics & tumor characteristics.
  - The percent receiving **TM** had **increased**.
  - The percent receiving MRM had gone down, but when added with TM then the combined percentage receiving mastectomy (TM+MRM) had increased.

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# Results – summary (cont.)

- Whites had a **lower** odds of **BCS** than blacks, higher odds for both TM & MRM.
- Younger women were **less likely** to receive **BCS** and more likely to receive TM.

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# Data Exchanges

Residents diagnosed or treated out of state

Required with 8 border states

Voluntary with 11 other states

Under very specific agreements assuring confidentiality

# Reporting Up

NPCR – CDC Data Visualization site

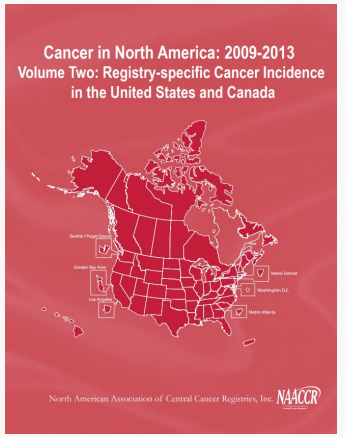
NPCR-SEER - US Cancer Statistics

American Cancer Society

NAACCR

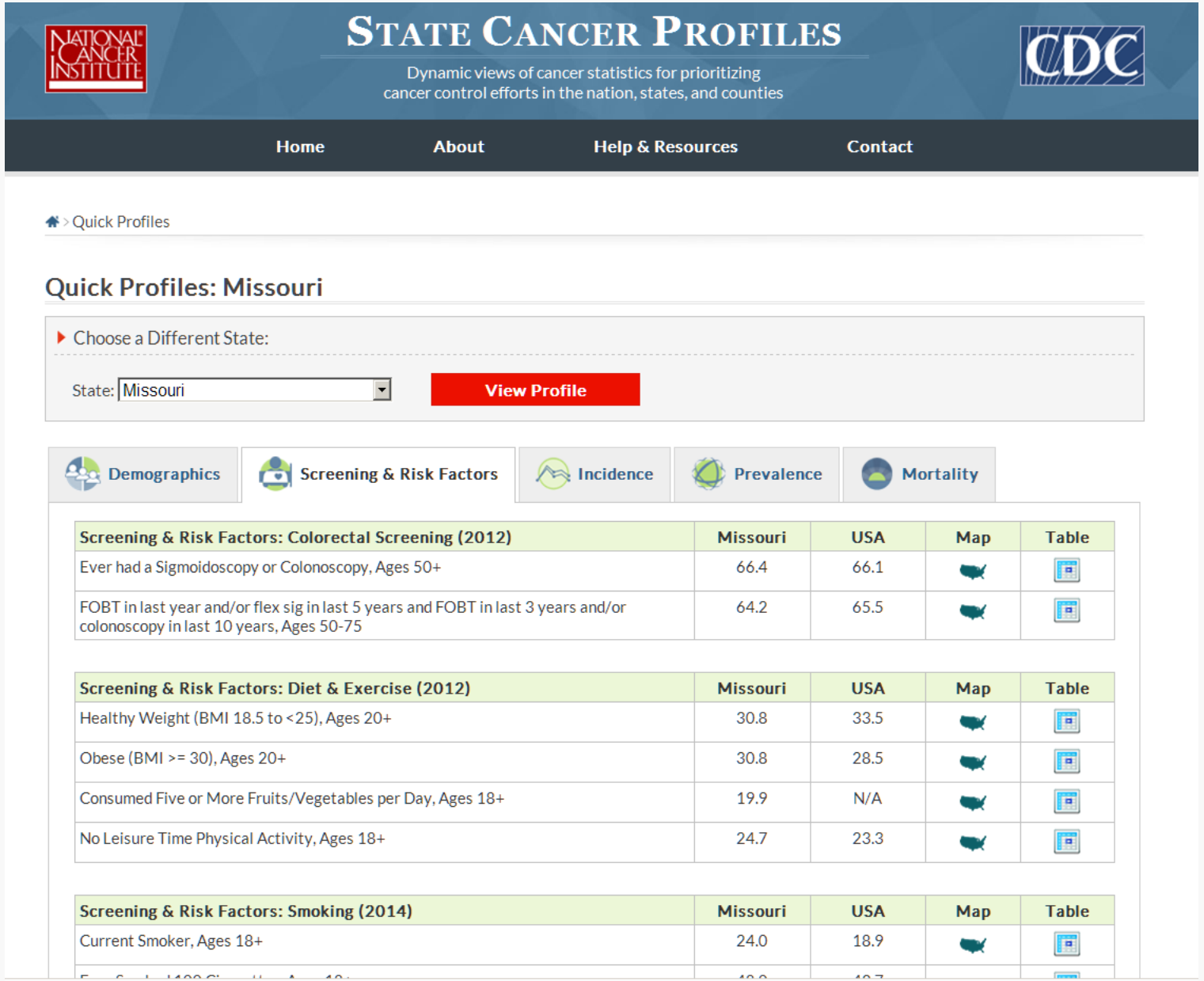
- Cancer in North America

IARC - Cancer in Five Continents


# Cancer Control P.L.A.N.E.T.

https://statecancerprofiles.cancer.gov/

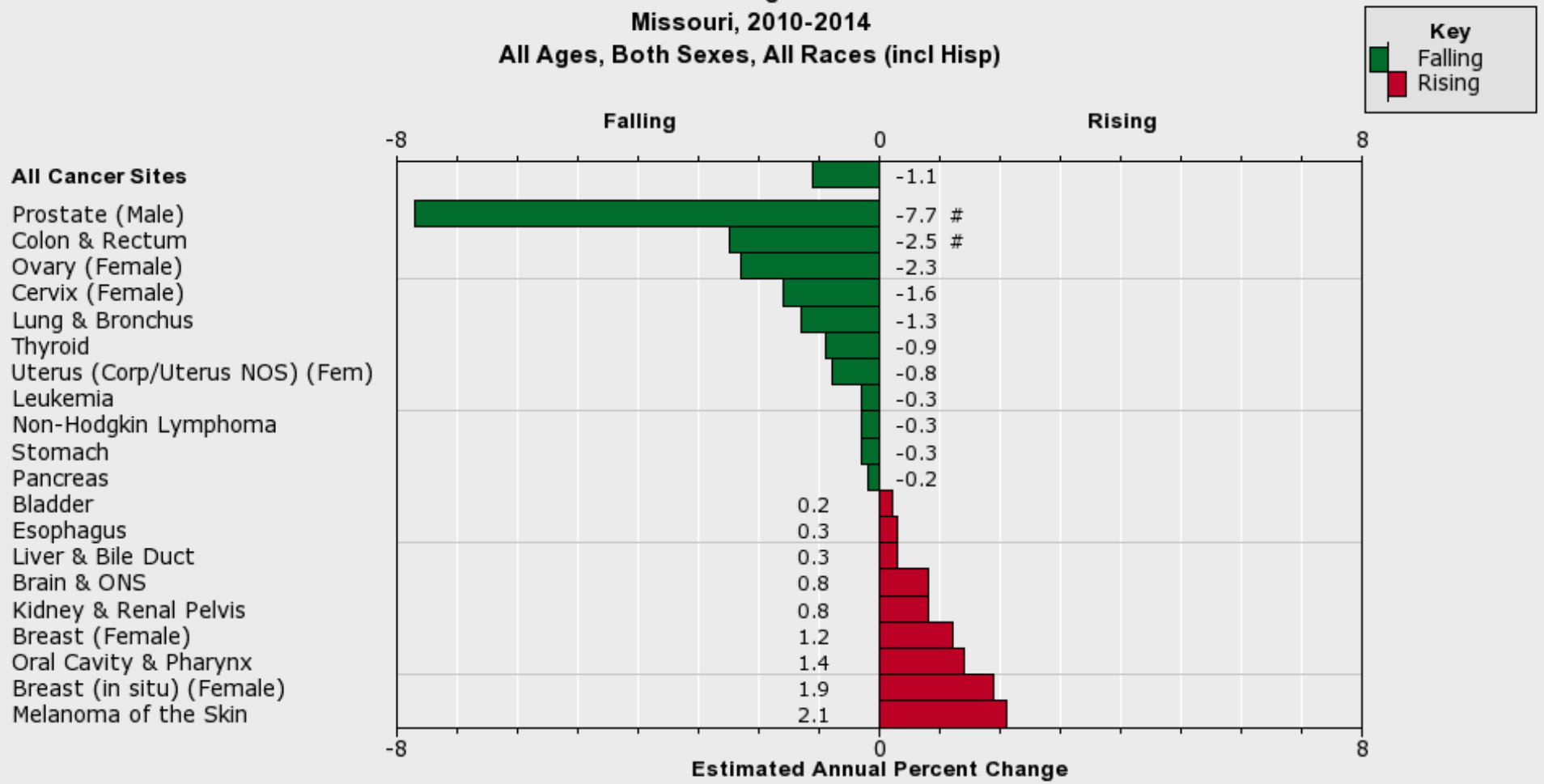



| Screening & Risk Factors: Colorectal Screening (2012) | Missouri | USA | Map | Table |
|---|---|---|---|---|
| Ever had a Sigmoidoscopy or Colonoscopy, Ages 50+ | 66.4 | 66.1 | | |
| FOBT in last year and/or flex sig in last 5 years and FOBT in last 3 years and/or colonoscopy in last 10 years, Ages 50-75 | 64.2 | 65.5 | | |

| Screening & Risk Factors: Diet & Exercise (2012) | Missouri | USA | Map | Table |
|---|---|---|---|---|
| Healthy Weight (BMI 18.5 to <25), Ages 20+ | 30.8 | 33.5 | | |
| Obese (BMI >= 30), Ages 20+ | 30.8 | 28.5 | | |
| Consumed Five or More Fruits/Vegetables per Day, Ages 18+ | 19.9 | N/A | | |
| No Leisure Time Physical Activity, Ages 18+ | 24.7 | 23.3 | | |

| Screening & Risk Factors: Smoking (2014) | Missouri | USA | Map | Table |
|---|---|---|---|---|
| Current Smoker, Ages 18+ | 24.0 | 18.9 | | |

## 5-Year Rate Changes - Incidence
## Missouri, 2010-2014
## All Ages, Both Sexes, All Races (incl Hisp)



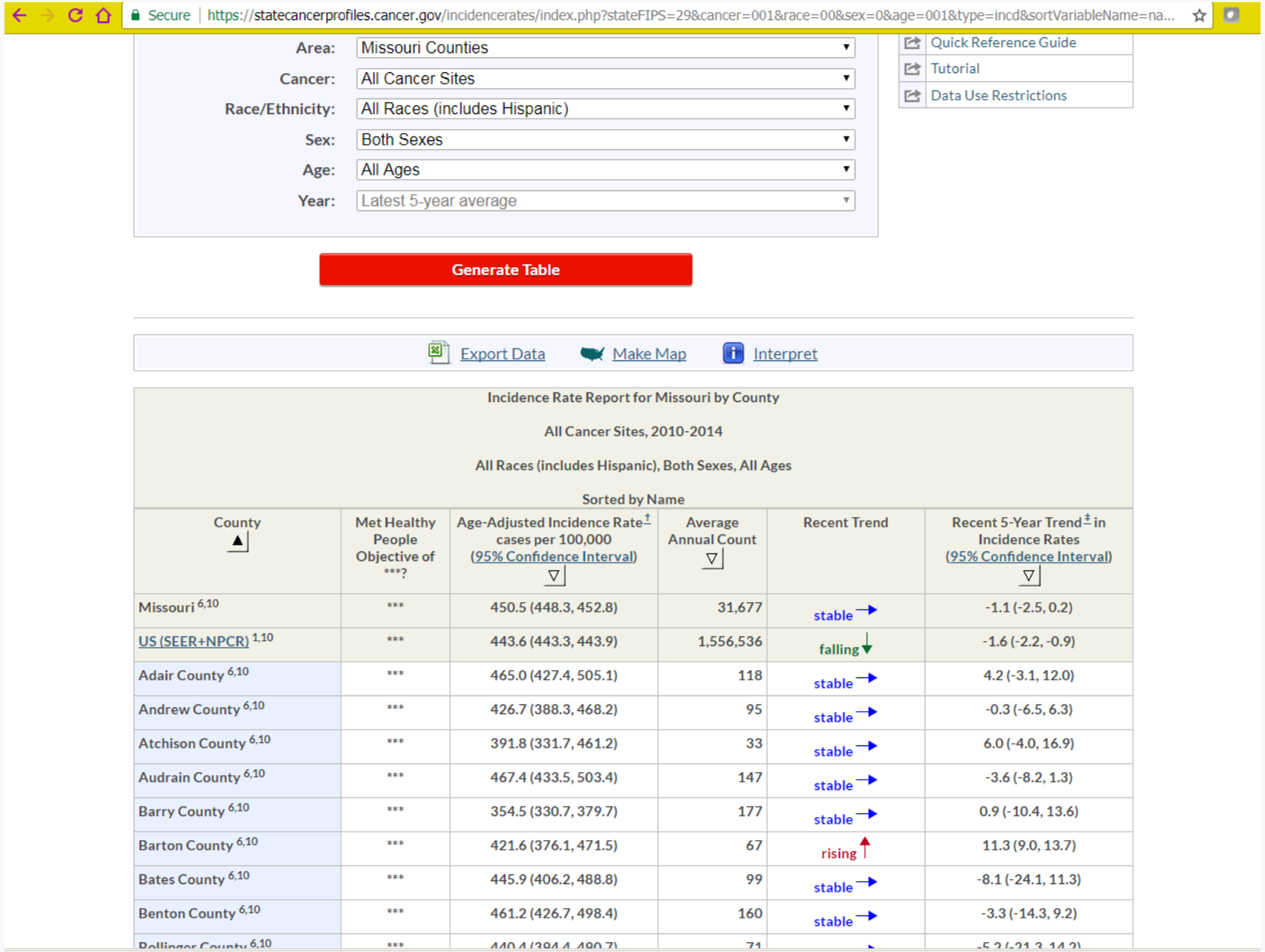

Created by statecancerprofiles.cancer.gov on 09/22/2017 10:31 am.

Source: Incidence data provided by the National Program of Cancer Registries (NPCR). EAPCs calculated by the National Cancer Institute using SEER*Stat. Rates are age-adjusted to the 2000 US standard population (19 age groups: <1, 1-4, 5-9, ... , 80-84,85+). Rates are for invasive cancer only (except for bladder cancer which is invasive and in situ) or unless otherwise specified. Population counts for denominators are based on Census populations as modified by NCI. The 1969-2015 US Population Data File is used with NPCR November 2016 data.

Please note that the data comes from different sources. Due to different years of data availablility, most of the trends are AAPCs based on APCs but some are EAPCs calculated in SEER*Stat. Please refer to the source for each graph for additional information.

# - The annual percent change is significantly different from zero (p<0.05).

# P.L.A.N.E.T. County Level Trends




| County | Met Healthy People Objective of ***? | Age-Adjusted Incidence Rate† cases per 100,000 (95% Confidence Interval) | Average Annual Count | Recent Trend | Recent 5-Year Trend‡ in Incidence Rates (95% Confidence Interval) |
|---|---|---|---|---|---|
| Missouri 6,10 | *** | 450.5 (448.3, 452.8) | 31,677 | stable → | -1.1 (-2.5, 0.2) |
| US (SEER+NPCR) 1,10 | *** | 443.6 (443.3, 443.9) | 1,556,536 | falling ↓ | -1.6 (-2.2, -0.9) |
| Adair County 6,10 | *** | 465.0 (427.4, 505.1) | 118 | stable → | 4.2 (-3.1, 12.0) |
| Andrew County 6,10 | *** | 426.7 (388.3, 468.2) | 95 | stable → | -0.3 (-6.5, 6.3) |
| Atchison County 6,10 | *** | 391.8 (331.7, 461.2) | 33 | stable → | 6.0 (-4.0, 16.9) |
| Audrain County 6,10 | *** | 467.4 (433.5, 503.4) | 147 | stable → | -3.6 (-8.2, 1.3) |
| Barry County 6,10 | *** | 354.5 (330.7, 379.7) | 177 | stable → | 0.9 (-10.4, 13.6) |
| Barton County 6,10 | *** | 421.6 (376.1, 471.5) | 67 | rising ↑ | 11.3 (9.0, 13.7) |
| Bates County 6,10 | *** | 445.9 (406.2, 488.8) | 99 | stable → | -8.1 (-24.1, 11.3) |
| Benton County 6,10 | *** | 461.2 (426.7, 498.4) | 160 | stable → | -3.3 (-14.3, 9.2) |
| Bollinger County 6,10 | *** | 440.4 (394.4, 490.7) | 71 | | -5.2 (-21.3, 14.2) |

# CDC:
# United State Cancer Statistics
# State vs. National

https://nccd.cdc.gov/uscs/statevsnational.aspx

Male | Female | Male and Female

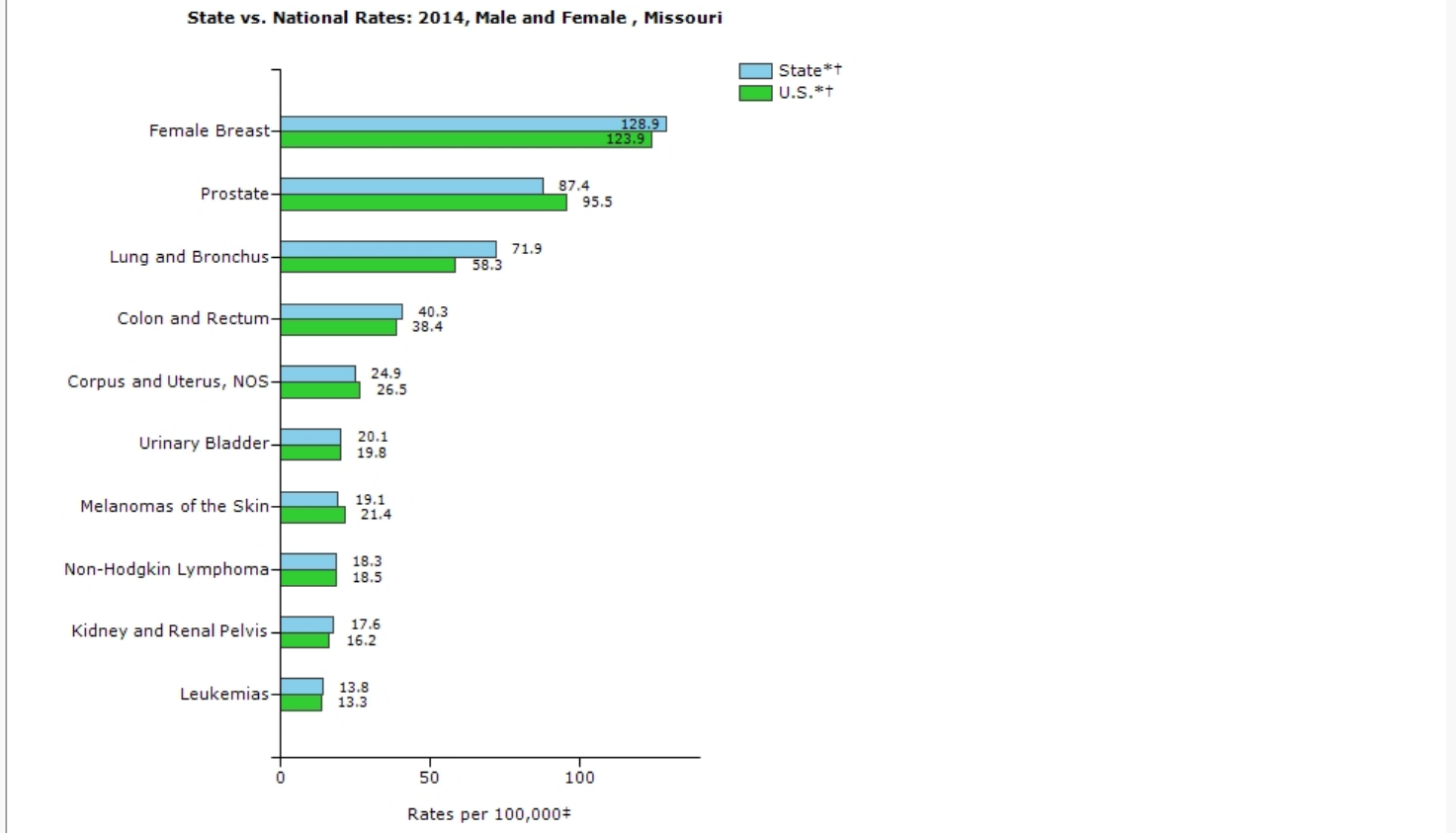
Incidence Rates | Death Rates

Age-Adjusted Invasive Cancer Incidence Rates for the 10 Primary Sites with the Highest Rates within State- and Sex-Specific Categories (Table 6.26.1MF) *†

★ Rates are per 100,000 persons and are age-adjusted to the 2000 U.S. standard population (19 age groups - Census P25-1130).

95% Confidence Interval : Hide Show

View tabular data



# How do Registrars make a difference?

One case at a time!

Together.