



June 16-23, 2017
Albuquerque Convention Center
Albuquerque, New Mexico

NAACCR 2017 ANNUAL CONFERENCE



ABSTRACT PROGRAM

Breaking Barriers in Cancer Surveillance



Table of Contents

Section	Page
---------	------

Poster Listings.....	3
----------------------	---

Registry of the Future	6
------------------------------	---

PLENARY PRESENTATIONS:

Tuesday, June 20

Plenary Session 1:

Breaking Barriers - International Cancer Surveillance

8:30am - 10:00am 8

Plenary Session 2:

Cancer Surveillance in Action: An International View

3:30pm - 5:00pm..... 10

Wednesday, June 21

Plenary Session 3:

Cancer Surveillance in American Indians/Alaska Natives/
Canadian First Nations

9:00am - 10:30am 11

Thursday, June 22

Plenary Session 4:

Registry of the Future Part I: Surveillance in an Era of
Emerging Technology and Precision Medicine

8:00am - 10:00am 13

Plenary Session 5:

Registry of the Future Part II: Visioning a Powerful Cancer
Surveillance System for North America

3:30pm - 5:00pm..... 15

Section	Page
---------	------

CONCURRENT PRESENTATIONS:

Tuesday, June 20

Concurrent Session 1

10:30am - 12:00pm..... 17

Concurrent Session 2

1:30pm - 3:00pm 31

Wednesday, June 21

Concurrent Session 3

11:00am - 12:45pm 42

Thursday, June 22

Concurrent Session 4

10:30am - 12:00pm..... 58

Concurrent Session 5

1:30pm - 3:00pm 71

Poster Sessions 82

Student Poster Sessions 115

Author Index 121

Program-at-a-Glance 126



NAACCR 2017 CONFERENCE Final Abstract Program

NAACCR would like to thank the poster, plenary, and concurrent session oral presenters for their contributions to the conference.

Electronic versions of the posters and oral presentations will be made available online at NAACCR2017.org after the conference.

Posters are available in Ballrooms A & B:

Monday, June 19	5:30pm to 7:00pm
Tuesday, June 20	7:00am to 5:00pm
Wednesday, June 21	7:00am to 12:00pm
Thursday, June 22	7:00am to 1:30pm

Poster Listings

All delegates are encouraged to take the opportunity to visit the posters to become familiar with some of the latest advances and research in the field.

Operational

- P-01** Using Natural Language Processing to Screen and Classify Pathology Reports
C. Moody
- P-02** Cancer Case Transmission to Central Cancer Registry Using Web Services (C/Next and Eureka)
T. Davison
- P-03** TNM Edits Are Staging Guardrails
D. Gress
- P-04** Utilizing Hospital Cancer Registry Operations to Implement Statewide Early Case Capture for All Cancers
D. Rousseau
- P-05** Finding “Zombies” in Your Database by Confirming Vital Status
D. O'Brien
- P-06** Oklahoma Central Cancer Registry Audit Process for Evaluating Data Quality and Completeness
S. Nagelhout
- P-08** How Important Is Non-Hospital Cancer Case Reporting to The New York State Cancer Registry's Ability to Describe the Cancer Burden? Let Us Count the Ways
A. Kahn
- P-09** Minimizing the Impacts of Address-County Uncertainty to North Carolina Cancer Statistics
C. Klaus
- P-10** Calibrating the NAACCR Hispanic Identification Algorithm (NHIA)
X. Zhang
- P-11** The Case Investigation of Cervical Cancer (CICC) Study: Chart Abstraction from Primary and Specialty Care Providers 5 Years Prior to Patient Diagnosis
A. Greek
- P-12** Meaningful Use Cancer Reporting: How Meaningful is it? An Analysis of Data Submitted to The Maryland Cancer Registry
D. Ng
- P-13** Addressing Reporting Gaps in Maryland
M. Mesnard
- P-14** Coding Software for Cancer Registry Industry and Occupation: National Institute for Occupational Safety and Health Industry and Occupation Computerized Coding System (NIOCCS)
S. Nowlin

- P-15** Presence of Codable Industry and Occupation in California Cancer Registry Data: Differences by Patient Demographics, Payor, Casefinding Source, And Type of Malignancy
S. Silver
- P-16** Improving the Accuracy of Type of Reporting Source Data Field at The New Jersey State Cancer Registry
S. Schwartz
- P-17** Exploring A New Dataset: Primary Care Prescriptions Pre- and Post-Cancer Diagnosis in England
L. Elliss-Brookes
- P-18** United Kingdom and Ireland Association of Cancer Registries (UKIACR) Performance Indicators 2017 Report
C. White
- P-19** Meaningful Use Registration and Reporting in Tennessee
J. Richards
- P-20** Childhood Cancer Data Collection: A Trend Analysis of Completeness and Data Quality From NPCR-ECC (October 2012 - October 2016 Submissions)
K. Zhang
- P-21** Data Quality Assessment of Melanoma Tumor Depth Measurement in SEER
C. Lam
- P-22** Death Clearance: Changing Follow-Back Focus from Physician to Han Facility
K. Harrington
- P-23** Improving Completeness of Treatment Documentation Through 15-Month Resubmission of Data in New Jersey
S. Hill
- P-24** Defining Risk Factor-Associated Cancers in Cancer Registry Data
S.J. Henley
- P-25** Assessing the Accuracy of Registry-Based Tobacco Use Status and Utility for Patient Recruitment into Tobacco Trials
S.J. Henley
- P-26** Resubmission of Data from Hospitals to Improve Completeness of Treatment Data: A Pilot Study
C. Phillips
- P-27** Use of Georgia Cancer Registry Data for Cancer Planning: Georgia's Approach
I. Walker
- P-28** Recovering Treatment in Puerto Rico: An Agreement Evaluation Using Administrative Claims Data
Y. Román-Ruiz

Poster Listings

P-29 Automated Tumor Linkage and The Future of Quality Control
S. Wood

P-30 The Completion of Chronic Comorbidity Reporting from Hospital Inpatient Discharge Data Varies by Observed Time Windows
Y. Yi

P-31 Leveraging Business Intelligence Tools in Support of Cancer Case Acquisition and Auto Versus Manual Processing of Data
G. Ciornii

P-32 Biorepositories and Cancer Registries: The Perfect Match
I. Zachary

P-33 Endless Opportunities: International and National Collaborations to Address and Solve Cancer Registry Challenges
J. Jackson-Thompson

P-34 Evolution of The Metro Chicago Breast Cancer Registry (MCBCR)
T. Dolecek

Research

P-35 Trends in Colorectal Cancer Survival in The Arab World, 1990-2009
Z. Zaidi

P-36 The Descriptive Epidemiology of Gynecologic Cancers: An International Comparison of Incidence, Survival and Mortality
Z. Zaidi

P-37 Assessing the Effectiveness of The England-Wide Be Clear on Cancer Campaigns
L. Elliss-Brookes

P-38 Frequency of Synchronous Brain Metastases at Time of Primary Cancer Diagnosis in the U.S., 2010-2013
Q.T. Ostrom

P-39 Cancer and Heart Disease Age-Adjusted Mortality Trends in California from 1970 to 2014
J.A. Killion

P-40 Obesity and The Impact on Endometrial Cancer in Oklahoma
R. Espinoza

P-41 Cancer Prevalence in California on January 1, 2013
Y. Chen

P-42 Trends in Cancer Survival in California by Health Insurance Status: 1997 to 2013
S. Gomez

P-43 The Impact of Obesity on Depression Among Adult Cancer Survivors Residing in Brazil
S.C. Oancea

P-44 Stage-Specific Cancer Survival in England
M. Eden

P-45 30-Day Mortality Following Systemic Anti-Cancer Therapy for Breast and Lung Cancer: Which Factors Increase the Risk?
L. Hounsome

P-46 Colorectal Cancer Incidence Trends in Massachusetts by Tumor Location, 1995-2014
A. MacMillan

P-47 A County-Level Ecological Examination of Cancer Screenings, Early Stage Incidence and Mortality in The State of Missouri
Y. Yoshida

P-48 Increased Incidence Trends of Colorectal Cancer Among Patients Younger Than 50 Years by Race/Ethnicity, Age, And Stage at Diagnosis in California, 1990-2013
R. Abrahao

P-49 The Relationship of Myelodysplastic Syndrome (MDS) and Chronic Lymphocytic Leukemia (CLL) to Other Hematopoietic Cancers in Massachusetts, 1995-2014
R. Knowlton

P-50 Trends in Prostate Cancer Incidence in New Jersey Men by Race/Ethnicity, Age Group and Stage at Diagnosis After Changes in Prostate Specific Antigen Screening Recommendations, 1990-2014
K. Pawlish

P-51 Colorectal Cancer Incidence Declining in New Jersey
J. Li

P-52 Hot-Spotting Preventable Cancers: Done Right
A. Holt, R. Delongchamp

P-54 Cancers with Increasing Trends Related to Obesity and Low Physical Activity in New Jersey: Variations by County
A. Stroup

P-55 Mapping Alaska Stomach Cancer Incidence Relative to the Geographic Distribution of Races in the Statewide Population
D. O'Brien

P-56 Assessing Colonoscopy Prevalence in Arkansas Using Small Area Methods
M. Astor

P-57 Variation in Routes to Diagnosis by Sex, Age and Deprivation Across Nine Years
L. Elliss-Brookes

Poster Listings

- P-58** Age-Period-Cohort Analysis of Melanoma, Leukemia and Thyroid Cancer in Ontario, Canada
Y. Wang
- P-59** Racial and Ethnic Differences in Breast Cancer Incidence in Young Women by Age and Breast Cancer Subtype
M. Shoemaker
- P-60** Characterization of Second Primary Malignancies in Ohio
J. Stephens
- P-61** Time Between Breast Cancer Diagnosis and Treatment Among Alaska Native People
S. Nash
- P-62** Recent Trends and Patterns in Diagnosis and Survival of Prostate Cancer by Race/Ethnicity in California
L. Liu
- P-63** Association of The Puerto Rico Tobacco Control Policies and The Decreasing Trend in Lung and Bronchus Cancer Mortality
M. Alvarado
- P-64** Worldwide Incidence of Hepatocellular Carcinoma: A 10-Year Forecast
E. Rodrigues
- P-65** HPV-Associated Cancer Incidence, United States 2009–2013
S.J. Henley
- P-66** The Burden of Rare Cancers in The United States
C. DeSantis
- P-67** Utilization of Proton Beam Therapy: A Population-Based Assessment of California, 1988-2014
A. Parikh-Patel
- P-68** Personalized Estimates of Prostate Cancer Overdiagnosis: Model Predictions Using Registry Data on Incidence Rates and Life Expectancy
R. Gulati
- P-69** Validate the Need for Procuring Potentially Life Saving Statewide Alert Systems for Various Cancer Misdiagnoses
D. Rodriguez
- P-70** Use of Adjuvant Chemotherapy in Patients with Stage III Colon Cancer in The Puerto Rico Hispanic Population
K. Ortiz-Ortiz

Student

- P-15** What are the Geographical Differences Among Children and Adolescents with Brain and Other CNS Tumors in California? Does any Clustering Exist?
D. Rodriguez
- P-25** Racial/Ethnic Differences in Thyroid Cancer Incidence in the United States, 2007-2013
K. Weeks
- P-35** The Impact of a Cancer Diagnosis on the Survival of HIV-Infected Individuals Living in South Carolina in the Post-Art Era
B. Hallowell
- P-45** The Impact of a Prior HIV/Aids Diagnosis on the Survival of Cancer Patients
B. Hallowell
- P-55** Adherence and Perceived Barriers for Screening of Hepatocellular Carcinoma Among High-Risk Chinese Patients
K. Xu
- P-85** Nebraska Immigrant Populations and Cancer: A Comprehensive Analysis Using the Nebraska Cancer Registry Database
K. Xu
- P-95** Estimating The Impact Of A Cancer Diagnosis On Life Expectancy By Socioeconomic Group For A Range Of Cancer Types In England
E. Syriopoulou
- P-105** Estimated Female Breast Cancer Mortality-to-Incidence Ratios (MIRS) on Senatorial Districts Grouped to County Boundaries in Missouri, 2008 - 2012
A. Ramadan
- P-115** Using Behavioral Risk Factor Surveillance System (BRFSS) Data to Estimate County-Level Colorectal Cancer Screening Prevalence in Missouri (MO)
J. Du
- P-125** American Thyroid Association (ATA) Guideline Adherence and Physician-Based Barriers and Facilitators of Initial Treatment for Differentiated Thyroid Cancer in Canada and the United States: A Systematic Review
T. Norwood

Registry of the Future

1RF1

USING ENCRYPTED IDENTIFIERS TO LINK DATA SOURCES TO SUPPORT THE NATIONAL CANCER DATA ECOSYSTEM

L Penberthy¹

¹National Cancer Institute, Bethesda, MD, United States

As part of the Beau Biden National Cancer Moonshot, the NCI's Blue Ribbon Panel developed 8 major areas that NCI should support in order to more rapidly advance cancer research. A key component that is necessary to support other special areas is the National Cancer Data Ecosystem (CDE). The CDE is envisioned to support the linkage of broadly diverse areas of cancer research from genomic studies and clinical trials to population based, patient engaged data to real world cancer data (including registries). In order to maximize the research value of each of these, the data sources must be linked at the patient level. However without the existence of a unique national patient identifier, this linkage is not possible without compromising patient privacy and confidentiality.

The NCI has identified a potential solution- the support of a common software that will encrypt and hash patient identifiers (PII) as the same hashed set of tokens from each research source. These common tokens can then used to link across multiple sources without breaching confidentiality. Investigators typically have PII for their study, but are not allowed to release. Using a common system that would enable creation of the same unique hashed identifier (based on the same PII elements) would permit investigators to securely combine their data. However, if investigators have differing sets of PII, they cannot generate the same encrypted tokens. The proposed solution is to leverage cancer registries, who maintain a broad set of PII, to serve as honest brokers for this scenario. Registries could receive the two encrypted identifiers and PII definitions (e.g. name, date of birth, etc.) that represent the same patient from the investigators. Registries know who the patient is because they maintain the broader set of PII. Registries could then generate a third but common hashed, encrypted token that could be provided back to the investigators to permit linkage. Thus registries could expand their role and serve as the honest brokers in support of the national cancer data ecosystem.

1RF2

ONE FUTURE OF CANCER SURVEILLANCE - BOTH SIDES OF THE COIN

AK Stewart¹

¹CancerLinQ, Alexandria, VA, United States

The ever-increasing volume of scientific discoveries, clinical knowledge, novel diagnostic tools and treatment options juxtaposed with rising costs in health care challenge physicians to rapidly identify, prioritize and utilize new information to deliver efficient and high-quality care to a growing and aging patient population. CancerLinQ, a rapid learning health care system in oncology, is an initiative of the American Society of Clinical Oncology (ASCO) that aims to address these challenges by collecting information from the electronic health records of large numbers of patients with cancer. CancerLinQ is, first and foremost, a quality measurement and reporting system through which oncologists can harness the depth and power of their patients' clinical records and other data to assess, monitor and improve the care they deliver. This system of cancer care often hinders providers from gaining clinically meaningful, longitudinal insights regarding patient care and outcomes, since the knowledge gained from individual patient encounters is rarely incorporated into any type of larger data collection spanning multiple providers or health care systems. To achieve the vision of CancerLinQ as outlined above, it becomes necessary to employ big data analytics. There are a number of definitions of 'big data,' but for purposes of this discussion, we adopt the definition provided by Gartner, Inc. "high-volume, high-velocity and high-variety Information assets that demand cost-effective, innovative forms of information processing for enhanced insights and decision making." In line with this definition, CancerLinQ is powered by large volumes of oncology practice records including structured and unstructured patient data and other practice data. In this presentation, an overview of CancerLinQ's approach to clinical surveillance will be summarized, including a description of its data ingestion and harmonization methodologies; examples of reporting tools made available to practices participating in the CLQ network; and preview collaborative initiatives with the SEER registries to use surveillance data within the CLQ platform and, more importantly, to support two-way data exchanges between CLQ practices and their respective regional registries.

Registry of the Future

1RF3

REDUCING RESPONDENT BURDEN THROUGH RECORD LINKAGE

P Murison¹

¹Statistics Canada, Ottawa, ON, Canada

The Social Data Linkage Environment (SDLE) at Statistics Canada promotes the innovative use of existing administrative and survey data to address important research questions and inform socio-economic policy through record linkage. The SDLE expands the potential of data integration across multiple domains, such as health, justice, education and income, through the creation of linked analytical data files without the need to collect additional data from Canadians. The Canadian Cancer Registry is one of the administrative data sets that has been linked within the SDLE. A description along with some of the possible uses of the SDLE within the cancer domain will be highlighted.

AUTOMATION OF THE DUPLICATE RESOLUTION PROCESS

P Murison¹

¹Statistics Canada, Ottawa, ON, Canada

The Canadian Cancer Registry is undergoing a pilot to automate the process for removing duplicate patient and tumour records for the 2015 data year. Lessons learned from the previous manual process will be shared along with the proposed automated process which is being developed by our methodology division.

1PL1

REGISTRIES IN THE FUTURE OF INTERNATIONAL CANCER CONTROL

H Bryant¹

¹Canadian Partnership Against Cancer, Toronto, ON, Canada

Registries have had a central role in contributing to international cancer control over the past several decades. While the original purpose of registries was as an epidemiologic tool in assessing the burden of incidence and mortality in different contexts, they have been used increasingly to investigate differences in the cancer experience itself. A great deal of this is due to international comparisons of survival analysis, which allows some early insights into potential differences in diagnosis and treatment across countries or social groups. Further work in linking registries to other databases, or using ancillary data collection, has been done in an attempt to explain differences in survival among similar jurisdictions. The work of the International Cancer Benchmarking Program is one such example, and examples of work to date and planned international comparisons will be given to explore the potential of registries and other data to approach these complex questions. The roles of registries for future analytical work in this area will also be discussed, with examples of situations where registries may be—or may not be—the instrument of choice to answer key questions.

1PL2

CANCER SURVEILLANCE IN MEXICO

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¹Instituto Nacional de Cancerología, Mexico City, Mexico, ²Unidad Médica de Alta Especialidad, Merida, Yucatan, Mexico

Mexico is a good example of a country in an epidemiological transition. No more than 50 years ago, cancer was the seventh cause of death; today is the third cause, with more than 84,000 annual deaths. Until 2014, there were no population-based cancer registries (PBCRs) in Mexico.

Objective: To describe the efforts of the Ministry of Health to organize a PBCR in the country.

Methods: With technical assistance from the IARC, the first PBCR was developed in the city of Mérida, which has a population of 900,000 inhabitants. All data was collected according to international standards and analyzed with the CanReg5 software. In addition, an initiative to establish a cancer registry law in Mexico was submitted to the national Congress and the Senate.

Results: The PBCR in Mérida has collected 1,117 incident cases in the year 2016. The more frequent malignancies among women were breast cancer, cervical cancer, endometrial cancer, colon and rectum cancer, and ovary cancer; among men, the most frequent were prostate, lung, colon and rectum, kidney, and non-Hodgkin's lymphoma. Following these results, a second PBCR has been planned in the city of Guadalajara, and will start activities during the second semester of 2017. Finally, the Congress and Senate have approved the law for the creation of a national PBCR. This law assures the financial support of this initiative.

Conclusions: Mexico urgently needs better cancer incidence and mortality data. This information is key for better planning of prevention, diagnosis, treatment, and palliative care for the growing number of patients with this disease. The recent approval of Mexican National Registry Law assures the financial support for optimal development of PBCRs in our country.

1PL3

**NCI CENTER FOR GLOBAL HEALTH: GLOBAL CANCER
SURVEILLANCE AND CANCER CONTROL**

L Stevens¹

¹National Cancer Institute, Rockville, MD, United States

The NCI Center for Global Health (CGH) has supported global cancer surveillance activities since its inception in 2011. This support has occurred in many of the WHO regions of the world and started within NCI prior to 2011. CGH seeks to build upon the long-standing surveillance work carried out by the NCI Surveillance, Epidemiology and End Results (SEER) program within the U.S. population and in partnership with the International Association of Cancer Registries (IACR).

SEER data is foundational for research at the local, national, and international levels. Through the CGH's work to support evidence-based cancer control plans at the country level, we emphasize the importance and fundamental nature of accurate surveillance data when designing, implementing, and evaluating a National Cancer Control Plan (NCCP). NCI's work with state cancer control plans has been ongoing for many years and CGH built on previous international efforts to provide technical assistance in NCCP development.

In the past few years, NCCP development has been supported through the International Cancer Control Partnership (ICCP <http://www.iccp-portal.org>), emphasizing a multi-stakeholder partnership to develop, implement, and evaluate plans. Specifically, we have focused on Central and South America and the Caribbean in recent years. The focus on data integration in NCCP has been supported by our cancer control work and our engagement with partners in the cancer surveillance space.

Plenaries

Tuesday Afternoon

2PL1

INTERNATIONAL COLLABORATIONS IN CANCER RESEARCH

M Coleman¹

¹London School of Hygiene and Tropical Medicine, Bloomsbury, United Kingdom

International collaborations in cancer research in the last 50 to 60 years have tackled geographic patterns and temporal trends in incidence, survival, prevalence, and mortality. They have also been used to address cancer etiology, from bacterial and viral infections to radiation carcinogenesis, as well as socio-economic, racial, and other inequalities in cancer incidence and survival. International collaborations have also produced consensus on vital research tools such as the classifications of topography, morphology, behavior, and stage at diagnosis; on clinical guidelines for cancer treatment; and on public health guidelines for cancer control. Many international associations have been created to focus on specific cancers, or to advance scientific domains such as epidemiology or cancer registration.

2PL2

WORKING INTERNATIONALLY WITH POPULATION-BASED REGISTRIES

M Berwick¹

¹University of New Mexico, Albuquerque, NM, United States

Working internationally with population-based registries, the Genes, Environment and Melanoma Study, an international, population-based study of melanoma, was funded in 1999 and is ongoing. There are eight population-based registries and one hospital-based registry involved: in Australia, New South Wales, and Tasmania; in Italy, Piedmont Cancer Registry; in Canada, the British Columbia Cancer Research Center and the Ontario Cancer Registry; and in the United States, the New Jersey Cancer Registry, the North Carolina Cancer Registry, the Orange County and Imperial Cancer Registry, and one hospital-based registry at the University of Michigan.

We have successfully enrolled 3,579 individuals with melanoma, 1,206 of these with multiple melanoma and 2,373 with single primaries. We have published more than 50 papers so far, with many on the docket. Response rates overall are 54%, which includes a 1-hour interview and a DNA sample. We will discuss the challenges and opportunities encountered in this long-term international study.

Tuesday, June 20 - Plenary Session 2

Cancer Surveillance in Action: An International View

3:30pm - 5:00pm

2PL3

ESTABLISHING A REGIONAL CENTRE FOR RESEARCH EXCELLENCE TO STUDY NON-COMMUNICABLE DISEASES AND CANCER IN INDIA

M Goodman¹, D Prabhakaran², T Gillespie¹, S Patel¹, R Nugent³, P Dhillon², R Gupta², G Rath⁴, V Mohan⁵, R Mehrotra⁷, R Swaminathan⁶

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Incidence rates of several non-communicable diseases (NCD) are rising disproportionately in low- and middle-income countries. To address this public health problem our consortium of international and domestic institutions has begun developing a Regional Center of Research Excellence (RCRE) to study high priority NCDs, such as cancers and diabetes, in India. The RCRE strategy is to link existing population-based cohorts that are well-phenotyped and bio-banked to cancer registries/institutes and collaborating clinical centers. The initial (planning) phase of RCRE focuses on New Delhi and Chennai to link the longitudinal Center for Cardiometabolic Risk Reduction in South Asia (CARRS) Surveillance Study cohort to existing population-based cancer registries in these two cities. In the longer-term we will expand RCRE activities to additional cohorts representing more states and varied levels of urbanization, and eventually to other South Asian countries. The RCRE is co-led by Emory University, Public Health Foundation of India, and Research Triangle Institute India in consultation with several premier US- and India-based clinical and research organizations. The initial RCRE infrastructure includes three shared resources: biorepository/laboratory core, data management core, and field data collection core. These shared resources are used in three on-going demonstration projects.

- 1) a study linking the CARRS cohort with cancer registries in New Delhi and Chennai; and comparing results of these linkages to self-reports and verbal autopsy-classified cancer deaths among cohort members;
- 2) a mixed methods study to describe the prevalence and correlates of cancer-related perceived stigma, investigate cancer- and diabetes-related knowledge and identify psychosocial barriers to timely diagnosis and treatment; and
- 3) an investigation of molecular features and underlying pathways of the association between DM and oral neoplasia in CARRS Oral Health sub-study participants.

3PL1

INCIDENCE OF PRIMARY LIVER CANCER IN AMERICAN INDIANS AND ALASKA NATIVES, US, 1999-2009

S Melkonian¹, M Jim¹, B Reilley², J Erdrich³, Z Berkowitz⁴, C Wiggins⁵, D Haverkamp¹, M White⁴

¹Centers for Disease Control and Prevention, Albuquerque, NM, United States, ²Indian Health Service, Rockville, MD, United States, ³Cedars-Sinai Medical Center, Los Angeles, CA, United States, ⁴Centers for Disease Control and Prevention, Atlanta, GA, United States; ⁵New Mexico Tumor Registry, University of New Mexico Comprehensive Cancer Center, Albuquerque, NM, United States

Background: Incidence of primary liver cancer in the U.S. has increased over the past decade and disproportionately impacts American Indian and Alaska Native (AI/AN) populations. Public health efforts to reduce liver cancer incidence in this population can be informed by evaluating regional variation in liver cancer rates.

Purpose: To provide a comprehensive evaluation of liver cancer incidence rates in AI/AN populations for the years 1999-2009.

Methods: We linked population-based cancer registry data with the Indian Health Service (IHS) patient registration databases to describe liver cancer incidence in non-Hispanic AI/AN persons compared to non-Hispanic whites (whites) in the U.S. Age-adjusted liver cancer incidence rates are expressed per 100,000. Annual percent changes (APCs) and trends were estimated using joinpoint regression analyses. Disease patterns were assessed for six geographic regions and for all regions combined.

Results: AI/AN persons have higher incidence rates of primary liver cancer when compared to whites overall (11.5 for AI/AN versus 4.8 for whites) and across all regions. AI/AN rates varied by region. For men, rates ranged from 10.3 (95% CI 7.2-14.3) in the East to 20.4 (95% CI: 17.6 - 23.5) in the Pacific Coast. For women, rates varied from 5.8 (95% CI: 3.5-8.9) in the East to 8.1 in the Northern Plains (95% CI: 6.1-10.5) and the Southwest (95% CI: 6.8-9.6). We observed a statistically significant increasing trend among AI/AN persons overall and for those living in the Southern Plains and Pacific Coast.

Conclusions: The present study suggests disparities in liver cancer incidence rates between AI/AN persons and Whites. We found substantial regional differences in incidence rates for AI/AN adults by sex, stage, and histologic subtype. These differences suggest opportunity for programs targeted at reducing prevalence of liver cancer risk factors and improving access to quality health care.

3PL2

CANCER SURVIVAL AMONG ALASKA NATIVE PEOPLE

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¹Alaska Native Tumor Registry, Anchorage, AK, United States, ²New Mexico Tumor Registry, Albuquerque, NM, United States

Background: Recent cancer survival trends among Alaska Native (AN) people are not well understood; survival has not been examined specifically in this population group since 2001.

Objective: This study examined survival among AN cancer patients for the five leading cancers in this population: lung, w, female breast, prostate, and kidney. Our primary goal was to determine whether we could detect any improvements in survival between cancers diagnosed 1991-2002 (early period) and 2003-2013 (late period). We also examined whether survival differed by age at diagnosis, stage at diagnosis, and sex.

Methods: Kaplan-Meier methods were used to calculate cause-specific survival for each of the targeted cancers by time period of diagnosis (1992-2002, 2003-2013) and by selected patient characteristics including sex, age at diagnosis, and stage of disease at diagnosis. Cox proportional hazards models were used to characterize changes in survival by time period while simultaneously adjusting for the above-listed patient characteristics.

Results: We observed a statistically significant improvement in 5-year survival over time from lung cancer (hazard ratio [HR] for later period, relative to earlier period [95%CI]: 0.83 [0.72, 0.97]), and a marginally non-significant improvement for colorectal cancer (HR [95%CI]: 0.81 [0.66, 1.01]). There were also site-specific differences in survival by age, and stage at diagnosis. Five-year cause-specific survival was highest for cancers of the prostate and breast (86.5% and 89.6%, respectively), and lowest for cancers of the lung (15.1%).

Conclusions: Over the past two decades, AN people have experienced improvements in survival from lung and colorectal cancers. Reasons for these improvements may include increased access to care (including screening), as well as improvements in treatment. Improving survival from all cancers should be a priority to reduce the burden of cancer among AN people and improve cancer control.

3PL3

AN INTRODUCTION TO A TRIBALLY OPERATED POPULATION BASED CANCER REGISTRY

S Khan¹, T Wickliffe¹, S Martinez²

¹Cherokee Nation, Tahlequah/Oklahoma, United States, ²University Of Oklahoma- College of Public Health, OKC/OK, United States

The Cherokee Nation Cancer Registry (CNCR) was established in 1997 and is the first and only tribally-operated population-based Surveillance Epidemiology and End Results (SEER) cancer registry in the country. The Cherokee Nation collects and maintains SEER data on all AI/ANs diagnosed with cancer residing in the 14-county Cherokee Nation Tribal Jurisdictional Service Area (CNTJSA) in Northeastern Oklahoma. AI/ANs in the CNTJSA face significant cancer disparities, with an overall age-adjusted cancer incidence of 664.6 per 100,000 compared to 474.7 for whites in the same region (2009-2014). A tribally-operated cancer registry provides the opportunity for Cherokee Nation to independently monitor cancer trends, examine patterns, and conduct cancer cluster investigations within their jurisdiction as well as evaluate and guide planning of Cherokee Nation cancer control programs.

Many AI/ANs who reside in the CNTJSA receive treatment for their cancer at facilities outside of the Cherokee Nation Health System (CNHS). Although CNCR exchanges data with the Oklahoma Central Cancer Registry to obtain diagnosis and treatment-related information for AI/ANs in the CNTJSA, extensive follow-up and information on behavioral and other risk factors is lacking. In order to have complete data on risk factors, cancer diagnosis, treatment, and survival, CNCR is currently creating the Cherokee Nation Health Analytics Core (CNHAC) which will link the CNCR with clinical treatment and outcomes data from health facilities both inside and outside of CNHS. The development of the CHHAC and the linkage project aims to build the capacity for Cherokee Nation to conduct comprehensive cancer research. Planned studies include 1) a feasibility study to identify factors that influence adherence to standard of care for breast cancer treatment among AI/AN women in the CNTJSA and 2) a pilot study examining breast cancer patterns of care and outcomes by diabetes status and glycemic control.

3PL4

CANCER SURVEILLANCE AMONG INDIGENOUS POPULATIONS IN CANADA

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People indigenous to Canada are recognized by the Constitution as "Aboriginal" and comprise three groups: First Nations, Métis, and Inuit. As of 2011, the 1.4 million people belonging to these groups accounted for just over 4% of Canada's population. Efforts to conduct routine cancer surveillance in these populations have been hindered by a lack of racial/ethnic identifiers in most Canadian cancer registries.

A probabilistic linkage between the 1991 Long Form Census and three other national administrative databases (non-financial tax summary files, the Canadian Cancer Registry and the Canadian Mortality Database) provided the opportunity to conduct the largest and first country-wide study of cancer incidence and survival among First Nation and Métis adults in Canada. We found that First Nation people (the largest of the three Indigenous groups) had higher incidence of colorectal, kidney and cervical cancers, and poorer survival compared to non-Aboriginal Canadians from 14 of the 15 most common cancers. Among Métis, we found higher incidence of breast, lung, liver, laryngeal, gallbladder and cervical cancers and poorer survival from prostate cancer compared to non-Aboriginal Canadians.

These results complement work being conducted at the provincial level and can serve as a benchmark for monitoring progress toward reducing the burden of cancer in indigenous population in Canada and eliminating disparities in cancer incidence and survival.

Registry of the Future Part I: Surveillance in an Era of Emerging Technology and Precision Medicine

8:00am - 10:00am

Plenaries

Thursday Morning

4PL1

ADVANCES IN INTEGRATING HEALTH CLAIMS DATA INTO CANCER REGISTRY DATA SYSTEMS

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Administrative billing data in the form of standardized claims offer a unique opportunity to enhance registry data for both surveillance and research purposes and to provide a model for integrating new sources of electronic data into the registry network ecosystem. Cancer registries substantially support the research infrastructure in the US but must strive to continually enhance our value and footprint in this domain through focused efforts to increase the completeness of and expand the detail on data most needed by today's research community. Focusing initial efforts on the incorporation of existing, electronic data sources capturing reliable information seems a feasible first step toward achieving these goals in a cost-efficient manner that will minimize the burden on the overall surveillance data collection system.

Structured healthcare professional claims are one example of an existing data source that address both a need of and opportunity for registries today. This plenary session talk will provide a general overview of the ANSI 837, 5010 Healthcare Professional Claim, describe the need and value of these important data, and present one model for integrating these data into routine registry operations and registry datasets. Future opportunities afforded through these data will be discussed as well as opportunities and approaches to scale this work to other registries and to other datasets.

4PL2

SURVEILLANCE IN AN ERA OF EMERGING TECHNOLOGY AND PRECISION MEDICINE

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¹Los Alamos National Laboratory, Los Alamos, NM, United States

Background: Rapid advances in hardware infrastructure and machine learning technology is automating tasks that were previously possible only with trained human labor. The automation, when successful, not only allows the reallocation of human resources to tasks that still require human ingenuity, but, more importantly, allows the handling of unimaginable amounts of data with reasonable investment of resources. Such a change in scale may usher in a qualitatively different era of surveillance and precision medicine.

Purpose: The success of such an enterprise, however, depends on being able to effectively harness the power of large-scale computation, on understanding the differences between humans and machines, and on being able to reduce the error rate of automated processing to below that achievable with careful manual curation. DOE and NCI has recently partnered on a pilot project to engineer and evaluate such a capability. As part of this pilot, we plan to employ exa-scale computing to automatically extract features from text like ePath reports with measured reliability, to be able to efficiently link knowledge extracted from various data sources, and to demonstrate the utility of such large-scale processing ability with a few use cases of population-level analyses of clinical significance.

Approach: To enable extraction of knowledge elements, we have started training machine learning algorithms on existing SEER data using supercomputers at the DOE complex. Once trained, the models can be run without the need for supercomputers, and will extract various elements with known measures of certainty. As a result, a system can be designed to return results only on the subset of variables where the extraction is reliable and to flag those where further review would be beneficial.

Preliminary Results: The methods will be illustrated using the extraction of features like site, sub-site, behavior, grade, and laterality from ePath reports.

4PL3

BUILDING A CASE FOR THE COLLECTION OF GENOMIC DATA IN CANCER SURVEILLANCE

A Kurian¹¹Stanford University, Stanford, CA, United States

Genomic information is increasingly central to the diagnosis and treatment of cancer. This includes both acquired genomic changes in tumors that guide our understanding of prognosis and treatment selection, and inherited genetic mutations that predispose patients to develop cancer and may affect their treatment response and survival. Dr. Kurian will illustrate the need for genomic information to answer research questions using cancer registry data. She will discuss strategies for achieving the goal of genomic data collection in cancer surveillance.

Registry of the Future Part II: Visioning a Powerful Cancer Surveillance System for North America 3:30pm - 5:00pm

5PL1

WHAT ICD-11 MIGHT MEAN FOR CANCER REGISTRIES AND CANCER SURVEILLANCE

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The International Classification of Diseases (ICD) is revised periodically to take into account changes and advances in medical knowledge and terminology. The Tenth Revision of the ICD was first published by the World Health Organization in 1992 and was implemented in the United States for mortality coding and classification in 1999. It has been recognized for several years that a new revision of the ICD, an Eleventh Revision, was necessary. As a result, development of ICD-11 was initiated in 2007 and is nearing completion with a scheduled release in 2018. This presentation will describe the need for revision, the development process, the new electronic structure, advantages of ICD-11 over ICD-10, and ongoing work yet to be completed. In addition, this presentation will address the implications of the new revision for cancer registries and cancer surveillance, including the relationship between ICD-11 and the ICD-O and changes to ICD-11 affecting the neoplasms chapter.

5PL2

CDC'S VISION FOR THE FUTURE OF CANCER SURVEILLANCE

L Richardson¹

¹Centers for Disease Control and Prevention, Atlanta, GA, United States

Thursday Afternoon

Registry of the Future Part II: Visioning a Powerful Cancer Surveillance System for North America

¹National Cancer Institute, Bethesda, MD, United State

[illegible]¹Division of Cancer Epidemiology Rutgers School of Public Health[illegible]

A Expanding the Role of Cancer Registries

10:30am - 12:00pm

1A1

THE CHANGING ROLE OF THE CANCER REGISTRY: "BEYOND TUMOUR REGISTRATION"

L Bowers^{9,10}, G Noonan^{1,9}, P Murison^{2,9}, B Sidhu^{3,9}, K Ly^{4,9}, G Liu^{5,9}, J Castonguay^{8,9}, J Hamm^{6,9}, K Vriends^{7,9}, C St. Pierre^{8,9}, B Carlin^{2,9}

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Background: The Education and Training Work Group (ETWG) requested feedback to help define national training and education activities. The ETWG was formalized through the adoption of a Training and Education Framework developed by Statistics Canada to support provincial/territorial cancer registries (PTCRs), the data providers to the Canadian Cancer Registry (CCR), in the accurate coding of cancer data to aid in maintaining and improving the quality of data in the CCR.

Purpose: The purpose of the training and education needs assessment survey was to understand the broad mix of cancer registry professionals working in cancer registration across Canada, determine what training and education opportunities are currently being utilized within each PTCR, identify gaps in training and education, and to get feedback directly from the PTCRs and cancer registrars themselves.

Method: The survey was conducted in an electronic format and was split into two different questionnaires: one focused on the PTCR in general, and one focused on individual registrars.

Results: The registry staff survey shows that, in addition to coding and abstracting core incidence data, the role of cancer registries in Canada has been expanded with the collection of treatment data, collection and maintenance of specialized databases, relapse and remission information, research studies, follow up processes, and provincial/territorial outcomes. Training and education must meet the requirements of expanded responsibilities and knowledge of the ongoing changes in cancer treatments and technological advancements. Issues that registries face in providing ongoing training are funding and staffing changes, particularly due to retirements.

Conclusions: The national cancer registry staffing survey results provided insight into two areas of concern. With the majority of survey respondents in the 6-20-year range of experience, a consideration should be made to training initiatives that will maintain the high level of expertise of these individuals. In addition, the survey demonstrates that a high percentage of respondents will be in retirement age within 10 years. This portends a need to focus national training on basic coding skills in the future in order to assist registries with the burden of training new hires as the most experienced staff retire.

1A2

SURVIVORSHIP CARE PLANNING AND CANCER REGISTRIES: CAN WE HELP EACH OTHER WHILE ALSO HELPING PATIENTS?

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¹DB Consulting Group, Silver Spring, MD, United States; ²Centers for Disease Control and Prevention, Atlanta, GA, United States

Background: Cancer survivors have unique health needs which may extend for years or even decades after the end of their treatment. In order to encourage follow-up and patient engagement within the healthcare system, a number of expert organizations have recommended that patients receive a comprehensive treatment summary and survivorship care plan (SCP) which includes information on diagnosis, treatment received, possible late and long-term effects of treatment, and guidelines for follow-up care. However, delivery of SCPs is difficult due to limited time, resources, and options for reimbursement. Cancer registries can help clinicians provide SCPs in several ways, and they may be able to improve the quality of their own data at the same time.

Purpose: Examine how cancer registries can help hospital-based providers efficiently develop and deliver SCPs.

Methods: The Web Plus Survivorship Program is the latest addition to CDC's Registry Plus suite of software programs. The program provides a way to pre-populate SCPs with data from cancer registries, thus jump-starting the SCP development process. It was implemented in six states in 2016. Central registry users in all six states and hospital-based users in three states have participated in ongoing discussions about changes needed to make the program successful. Two group discussions were also conducted with these stakeholders to prioritize a list of possible improvements to the program.

Results: There are three primary ways cancer registries can help hospitals deliver SCPs to patients. These include: (1) identification of patients eligible to receive SCPs, (2) consolidation of data from multiple hospitals, and (3) pre-population of the care plans with data from a NAACCR abstract. We will discuss successes and challenges to each of these elements, as well as the opportunities that SCPs may provide to improve cancer registry data and case finding.

Conclusions: Cancer registries can expand the use of data collected through routine operations to directly improve patient-centered care through the creation of SCPs. Together, registries and clinicians can leverage existing resources to facilitate development of SCPs, thereby providing cancer survivors with a concise tool for navigating ongoing care.

1A3

AN APPROACH TO STRENGTHEN CANCER PREVENTION AND CONTROL IN THE ENGLISH- AND DUTCH-SPEAKING CARIBBEAN

S Quesnel-Crooks¹, G Andall-Brereton¹

¹Caribbean Public Health Agency (CARPHA), Port of Spain, Trinidad and Tobago

It is well established that high quality population-based cancer registration is pivotal to cancer prevention and control (IARC, 2014). Cancer registration is limited in the Caribbean. Consequently, there is a paucity of information on the burden of cancer and evidence-based decision-making for cancer prevention and control is lacking. To strengthen cancer surveillance in the English- and Dutch-speaking Caribbean, the Caribbean Public Health Agency (CARPHA) is collaborating with the International Agency for Research on Cancer (IARC) and other partners to develop and implement the IARC Caribbean Cancer Registry Hub. The Hub aims to strengthen cancer registration by building capacity through technical support, training, networking opportunities, and collaborative research.

Over the period 2015-2016, the Caribbean Hub completed 4 in-country site assessments to document the status of cancer registration and identify opportunities for improvement. The Hub conducted a basic training workshop for 13 countries on the fundamentals of cancer registration and a cancer registration software training in the use of CanReg5 was done for 5 countries. Collaborative research initiatives are ongoing, and the Hub contributed to an analysis of leading causes of cancer-related deaths in the Caribbean (Razzaghi, et al., 2016). The information and evidence generated through these activities will guide policy for strengthening cancer registration and for improving prevention and control of cancer in the region. The continued support of external partners with considerable experience in cancer registration is essential for improving cancer registration and surveillance in the Caribbean.

1A4

FUNDAMENTAL LEARNING COLLABORATIVE FOR THE CANCER SURVEILLANCE COMMUNITY (FLccSC)

G Levin¹, S Bolick², S Peace¹, M Castera², J MacKinnon³, P Stearns⁴, J Pratt⁴

¹Florida Cancer Data System, Miami, FL, United States; ²South Carolina Central Cancer Registry, SC Department of Health and Environment, Columbia, SC, United States; ³MacKinnon Group, Miami, FL, United States; ⁴Advanced Consulting Enterprises, Inc., Miami, FL, United States

Background: FLccSC is a standalone, web-based learning management system (LMS) developed collaboratively by the Florida Cancer Data System and the South Carolina Central Cancer Registry for the specific needs of our respective states. Funding for the initial development was from both states, including carryover funding from CDC/NPCR.

Purpose: FLccSC was developed to address the growing need for providing essential education to our central registry staff/ statewide reporters in spite of diminishing funding and limited personnel. FLccSC provides cancer surveillance professionals in Florida and South Carolina access to a state-specific, web-based distance learning platform. Courses are designed for students of all experience/skill levels. There are courses (educational content and/or quizzes) for those who are new to the cancer surveillance field and continuing education courses for the seasoned professional.

Methods: In order to accommodate the varying needs of Florida and South Carolina, FLccSC was designed to be scalable and customizable. FLccSC is a fully functioning LMS administered and maintained on a central server managed by Florida. FLccSC has a 'frontend' where the students log into and a 'backend' where the respective registry develops coursework and manages their own system.

Results: All central cancer registries (CCR) are invited to join the collaborative. FLccSC's design features allow each CCR's LMS to be a stand-alone and customized platform (including their web address, logos and branding). The respective CCR develops and maintains their own state-specific educational platform for the cancer registry/surveillance professionals within their jurisdiction. They will be able to present original content and/or present content developed by other CCRs within the collaborative. The student will receive a registry-specific certificate of completion for all work successfully completed, which includes CEU credits if applicable.

B Registry Data Tools

10:30am - 12:00pm

1B1

SEER IMPLEMENTATION OF THE MULTIPLE PRIMARY AND HISTOLOGY CODING RULES

F Depry¹, C Kosary²

¹Information Management Services, Inc., Calverton, MD, United States; ²National Cancer Institute, Bethesda, MD, United States

IMS collaborated with the Kentucky Cancer Registry to implement a fully automated set of the SEER Multiple Primary and Histology Coding Rules (MP/H). The end result is a Java library and API that is freely available for use in other software. This project was sponsored by the SEER Program of the National Cancer Institute. The Florida Cancer Data System (FCDS) contributed to the overall project via their collaboration with KCR.

The rules have been implemented as a Java library that is publicly available on the internet. That Java library is currently used by the SEER registry software, SEER*DMS and the SEER Abstracting Tool. The rules have also been exposed in SEER*API as a web service and can be embedded in any existing software. In addition to that API, SEER has created a web site where you can review the MP/H results by entering data for two cancer diagnoses.

This presentation will include a summary of the work that has been done with KCR to create the library and a review of its implementation in different software. It will also demonstrate how existing software can use the new API.

1B2

I SEE IT NOW! NEW DATA VISUALIZATIONS OF U.S. CANCER STATISTICS

L Pollack¹, S Singh¹, C Bledsoe³, A Kolli², B Ryerson¹, V Benard¹, L Richardson¹

¹Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, GA, United States; ²Northrop Grumman, Atlanta, GA, United States; ³DB Consulting Group, Atlanta, GA, United States

Background: Cancer surveillance data must be easy to access, understand, and share. *U.S. Cancer Statistics (USCS)*, the official federal report on cancer incidence and mortality, is publically available. However, the user interface requires multiple input choices to obtain specific rates, often only available in a tabular format.

Purpose: To enable the public and cancer planners to more easily explore and use USCS, CDC updated the web-based USCS report with interactive graphics that summarize the data and encourage comparisons between cancer sites, states, demographic groups, and over time.

Methods: A workgroup of cancer registrars, program planners, epidemiologists, computer programmers, and communication specialists was convened to improve the visual data presentation of USCS with graphics that will be automatically updated with annual USCS data submissions. Storyboards were created to visually describe U.S. cancer burden, incidence and mortality over time, and state-specific data in comparison to national rates. A dedicated programmer utilized an embedded analytics software to create dashboards that help users interpret USCS data using visual displays. Future refinement will be based on feedback and usability testing.

Results: The USCS Data Visualization website includes five webpages: Overview; U.S. Cancer Demographics; Cancer Trends; State Cancer Overview; State Data and Ranking; followed by technical notes and additional resources. Data are displayed as maps and bar charts with interpretive text when users scroll over each graphic. Users can customize displays of overall and cancer-specific statistics, view data as a table, and share each page via social media.

Conclusions: Surveillance data is fundamental to measure progress and direct action. CDC's new interactive, user-friendly USCS data visualizations are designed to make USCS more accessible to the public and to enable improved interpretation and dissemination of cancer data.

1B3

TRANSITIONING FORWARD WITH EDITS50 TOOLS: EDITWRITER V5 AND GENEDITS PLUS V5

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Background: EDITS50 tools were released in early 2017, consisting of a fully re-written Edit Engine and application programming interface (API), new metafile format (SQLite), and new versions of EditWriter and GenEDITS Plus. The project was undertaken by NPCR to redesign the EDITS tools to use modern programming technologies. Enhancements were becoming difficult to accommodate due to the constraints of the older technology. Significant variations were introduced into NAACCR v16 edits and edit sets due to differences in standard setter requirements with the addition and modification of TNM edits. This has caused some confusion for those selecting edits to include in edit sets.

Purpose: To present the new and powerful features of the EDITS50 tools; to review the purpose of tags and how tags can be used as unique identifiers; and to review transition to EDITS50 tools for 2018 EDITS metafiles.

Approach: An overview of enhancements and new features of the software programs will be provided. Since the Help documentation provides step-by-step instructions and detailed explanations for EDITS Language functions, this presentation will highlight specific sections of the Help documentation and will not serve as training in the use of the EDITS50 tools. The purpose of tags as unique identifiers will be explored and may alleviate some of the confusion when selecting edits to include in edit sets.

Results: This presentation will illustrate the use of tags for metafile administrators to quickly determine edit name changes; identify multiple versions of edits; and describe the enhancements to EDITS50 tools in an effort to assist registry staff and prepare the registry community for transition.

Conclusion: This presentation will summarize the enhancements to the EDITS50 tools, highlight key functions documented in the Help content, and illustrate how the enhancements will help registries manage updates to their edits sets.

1B4

ADVANCING THE INFRASTRUCTURE FOR CANCER SURVEILLANCE: ENHANCING SEER*DMS THROUGH A MULTI- TIERED USABILITY ASSESSMENT APPROACH

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¹National Cancer Institute, Rockville, MD, United States

Background: The Surveillance, Epidemiology, and End Results (SEER) Program has started to employ innovative approaches to augment and automate data acquisition and processing, such as natural language processing (NLP) techniques for data extraction and quality checking. The SEER*DMS system has been a pivotal part of SEER initiatives and SEER cancer registry operations since 2005. To ensure that the system is optimally positioned to handle the new influx of data, improve on existing registry workflows, and is configured to seamlessly integrate machine-learning technologies for information processing for the registry community, SEER has embarked on a comprehensive usability assessment employing a multi-tiered framework.

Objective: A usability assessment framework is being developed to analyze SEER*DMS using both expert heuristic and user-level evaluations. This assessment framework will support SEER's aim of expanding the scope of current data collection capabilities, integrating new innovative technologies and processes, and optimizing the system for improved registry workflows.

Approach: An external expert review of SEER*DMS was conducted in 2016 identifying key opportunities for improvement. The recommendation for a usability assessment on SEER*DMS was prioritized to drive the subsequent system enhancements. The proposed evaluation framework will have a multi-tiered approach. The assessment will include (1) a high-level system heuristic analysis and (2) system walkthroughs with registry users to target improvements from a user perspective. The findings from this approach will be used to guide system enhancements.

Results: The usability assessment project is anticipated to provide evidence-based recommendations to improve the efficiency of SEER*DMS for the evolving needs of the cancer registry community. Through these efforts, the SEER program can identify key needs of registry users and target specific areas of SEER*DMS for enhancements.

Improving Cancer Treatment Linkage

10:30am - 12:00pm

1C1

THE CANADIAN CANCER TREATMENT LINKAGE PROJECT

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Background: The Canadian Cancer Registry (CCR) is a dynamic database of all Canadian residents who have been diagnosed with cancer since 1992. The CCR does not contain information regarding cancer treatment.

Purpose: The purpose of the project was to assess the feasibility of adding surgical treatment data elements for six types of cancer (breast, colorectal, prostate, bladder, thyroid, and lung) to the CCR.

Methods/Approach: Linkage was conducted at Statistics Canada using the Social Data Linkage Environment (SDLE). Surgical treatment information from the Discharge Abstract Database (DAD) and the National Ambulatory Care Reporting System (NACRS) were linked with the CCR and the Canadian Vital Statistics Mortality Database. The tumor cohort population included those 19 and older who were diagnosed with one of the six cancers between January 1, 2010 and December 31, 2012.

A list of surgical treatment codes was developed by cancer type based on published treatment guidelines (NCCN and others). The Canadian Classification of Health Interventions was used to define each surgical intervention in the DAD and NACRS. Consultations were held with clinicians, classification specialists and technical working group members to validate code selection. Surgical interventions occurring within 1 year of the date of diagnosis were captured.

Results: Linkage rate of the CCR to the derived record depository in SDLE was 99%, and approximately 92% for the DAD and NACRS varying slightly by year. Surgical treatment rates were calculated by cancer and province. Derived variables related to the surgical procedures and surgical intervention dates were created for each cancer site.

Conclusions: The results of this study demonstrate that through linkage to hospital data it is feasible to obtain surgical treatment data related to the six cancers studied.

1C2

FINDING TREATMENT DATA IN ALL THE RIGHT PLACES! LINKING HOSPITAL ELECTRONIC MEDICAL RECORDS & PRESCRIPTION DISPENSING DATA TO THE CENTRAL REGISTRY.

K Vriends¹, M MacIntyre², K McDougall², G Bartlett³, J Liddy², L Broadfield², C. Louzado⁴

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⁴Canadian Partnership Against Cancer, Toronto, ON, Canada

Objectives: Outline new options to enhance population-level systemic (ST) and radiation (RT) data collection in the central registry (CRIS) via linkage to Drug Information (DIS) and Radiotherapy Medical Record Systems (EMR).

Background: Nova Scotia and Prince Edward Island piloted new data collection options for ST and RT using a province-wide DIS and RT EMR. Pilot funding was obtained from the Canadian Partnership Against Cancer to develop and test standardized, electronic data extracts from these new sources and test linkage into the CRIS.

Purpose: The project focused on: development of a standard DIS extract of dispensing data for cancer systemic therapies and an RT EMR extract from ARIA; building CRIS structures to house both DIS and RT data; and tools to support automated import. Data governance and quality, report testing, and sustainability were also examined.

Methods: Specifications for the DIS and RT data extract content/layout, a CRIS data structure, and interfaces for file import were developed. An ST drug agent and regimen-based reference tool was created for staff. Provincial Health IDs for CRIS cases were used for linkage to the DIS along with an ST Drug filter file to identify dispensing records. RT treatment records were linked to the CRIS patient with the functionality for registrars to select the tumor for linkage or auto-populate RT data directly to the record.

Results: Multiple data extract/import cycles were tested. Abstractors used the ST data to create a full patient profile (community and inpatient). RT files were successfully imported/linked with CRIS records. Usability and comparability of data for reporting was assessed.

Conclusion: Evolving clinical data sources provide improved options for collecting cancer treatment data to support population level cancer surveillance. New work flows and resources are required and further work is recommended to examine national treatment data standards.

1C3

DEVELOPING AN ONCOLOGY TREATMENT RESOURCE FOR CLAIMS-BASED RESEARCH: INNOVATION WITH MEDICATIONS

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Background: Claims data are an increasingly useful component of cancer research and despite wide use, there is no single guidance about selection of appropriate codes (HCPCS, NDC, CPT, ICD-9, ICD-10). Cancer registries can use claims data in registry operations for case finding or for supplementing treatment data. There is currently wide variability in the selection of appropriate codes which could influence research and registry operations. A comprehensive resource is needed to standardize mapping of relevant codes for use in automated systems, for manual abstraction, or for research analyses.

Purpose: To develop an interactive database tool for the extramural community to use as a reference and as a resource to facilitate cancer surveillance, epidemiology, and pharmacoepidemiology research.

Methods: Medication dispensing and administration use two main classifications for billing purposes: Healthcare Common Procedure Coding System (HCPCS) and National Drug Codes (NDCs). The HCPCS database primary inclusion criteria were the presence of the drug in the SEER*Rx database or the CMS 2016 HCPCS Index, and the drug receiving FDA approval. Broad medication categories were matched with SEER*Rx. The NDC database integrates daily updates to provide nearly real time, complete information on oncology medications available through the clinician-reviewed interactive tool.

Results: The Cancer Medications Enquiry Database (CanMED) includes both HCPCS and NDC codes and is the medication-focused aspect of this larger initiative. The beta version of the interactive tool includes chemotherapies (261), immunotherapies (95), and chemical moieties (1958). There is an added focus on the application of these results to registries.

Conclusion: This resource facilitates enhanced treatment-related research and improves the quality of treatment-related medication data collection among SEER registries using claims in their operations structure.

1C4

LINKAGE OF INDIANA STATE CANCER REGISTRY AND INDIANA NETWORK FOR PATIENT CARE DATA

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¹Indiana State Department of Health, Indianapolis, IN, United States; ²Merck, Kenilworth, NJ, United States; ³Regenstrief Institute, Inc., Indianapolis, IN, United States; ⁴Indiana University School of Medicine, Indianapolis, IN, United States; ⁵Eskenazi Health, Indianapolis, IN, United States; ⁶Veterans Administration Health Services, Indianapolis, IN, United States

Background: Large automated electronic health records (EHRs), if brought together in a federated data model, have the potential to serve as valuable population-based tools in studying the patterns and effectiveness of treatment. The Indiana Network for Patient Care (INPC) is a unique federated EHR data repository that contains data collected from a large population across various healthcare settings in Indiana. The INPC clinical data environment allows quick access and extraction of information from medical charts.

Purpose: The purpose was to evaluate two different methods of record linkage between the Indiana State Cancer Registry (ISCR) and INPC, determine the match rate for linkage between the ISCR and INPC data for patients diagnosed with cancer, and to assess the completeness of the ISCR.

Methods: Deterministic and probabilistic algorithms were applied to link ISCR cases to the INPC. The linkage results were validated by manual review and the accuracy assessed with positive predictive value (PPV). Medical charts of melanoma and lung cancer cases identified in INPC but not linked to ISCR were manually reviewed to identify true incidence cancers missed by the ISCR.

Results: Both deterministic and probabilistic approaches to linking ISCR and INPC had extremely high PPVs (>99%) for identifying true matches for the overall cohort and each sub-cohort. The estimated completeness of capture by the ISCR was 84% for melanoma and 98% for lung cancer.

Conclusion: Cancer registries can be successfully linked to patients' EHR data from institutions participating in a regional health information organization (RHIO) with a high match rate. A pragmatic approach to data linkage may apply both deterministic and probabilistic approaches together for the diverse purposes of cancer control research. The RHIO has the potential to add value to the state cancer registry through the identification of additional true incident cases.

10:30am - 12:00pm

1D1

E Feuer¹¹National Cancer Institute, Bethesda, MD, United States

The Statistical Research and Applications Branch (SRAB) of the National Cancer Institute (NCI) has built an EXCEL template that can be used by registries to develop their own composite indices and submit them to the NCI for presentation in the CI*Rank website. This talk reviews the format of the template as well as practical considerations for the development of composite indices. The template requires the specification of geographic units, the distribution (Poisson, binomial, or normal) for each measure that is part of the composite, and mean and standard error for each measure for each geographic unit. In most cases, to avoid large variability, the geographic units should be groups of counties rather than individual counties. Composite indices should combine a combination of standard cancer statistics such as cancer screening or treatment rates. Modeled small area estimates can be used, but with caution. To the extent possible, measures should be relatively uncorrelated. Measures should be equally weighted unless there is a good reason to do otherwise.

1D2

T Tucker¹

¹Kentucky Cancer Registry, Lexington, KY, United States

Over the years, the Kentucky Cancer Registry has developed a simple composite Rank Sum Index (RSI) to estimate the cancer burden for lung, breast, and colorectal cancer within each of the state's 15 Area Development Districts (ADDs). These indexes have been constructed and presented to the District Cancer Councils in each of the 15 ADDs on an annual basis. The Cancer Councils use these data to help focus their attention on the cancers that represent the greatest burden in their ADD, to help guide the implementation of evidence-based interventions, and to measure changes in the cancer burden over time. The creation of this simple RSI is based on the logic model that demographic characteristics of a population (measures of poverty and literacy) influence risk behaviors (smoking or not being screened) which contribute to the cancer incidence rate and ultimately the cancer mortality rate. This presentation will describe the logic behind creating an index, the method of creating the simple RSI, and its strengths and limitations. This presentation will also describe the potential impact of using an index of the cancer burden for cancer prevention and control.

1D3

B Huang¹

¹Kentucky Cancer Registry, Lexington, KY, United States

The RSI is developed from a combination of factors ranging from demographics to cancer incidence and mortality to provide a comprehensive view of cancer burden at the community level. A shortcoming of the RSI is that measures with little inherent variability contribute equally to the final composite measure as those with large variability. It also does not have confidence intervals to provide a measure of precision which can be quite useful in application. To address these problems, a Modified Sum Index (MSI) was developed to take into account of magnitudes of observed values. Instead of summing ranks for each measure as in the RSI, the MSI calculates standardized Z-scores for each measure then ranks the combined Z-scores for the composite measure. A direct simulation approach was used to generate individual and simultaneous 95% CIs for the rank MSI assuming each measure follows a certain distribution (i.e., Poisson distribution, Binomial distribution). An uncertainty measure was also calculated. The work has been implemented in the NCI Ci*Rank website. This presentation will discuss the methods and demonstrate how the RSI for lung cancer in Kentucky was developed.

1D4

L Zhu¹

¹National Cancer Institute, Bethesda, MD, United States

Health indices provide information to the general public on the health condition of the community. They can also be used to inform the government's policy making, to evaluate the effect of a current policy or health care program, or for program planning and priority setting. It is a common practice that the health indices are ranked and the resulting ranks are reported as fixed values. We argue that the ranks should be viewed as random, and hence should be accompanied by an indication of precision (i.e., confidence intervals) when they are reported. A technical difficulty in doing so is how to account for the dependence among the ranks in the construction of confidence intervals. We developed a novel Monte Carlo method for constructing the individual and simultaneous confidence intervals of ranks. The method was originally developed to rank age-adjusted rates, and has been expanded to rank other health indices such as proportion of smokers from a survey, or a composite index that combines several measures. The method has been implemented in ranking age-adjusted cancer incidence and mortality rates by state, county, and special region in the U.S. at <https://surveillance.cancer.gov/cirank/>.

E Survival Analysis

10:30am - 12:00pm

1E1

ASSESSMENT OF LEAD-TIME BIAS IN ESTIMATES OF RELATIVE SURVIVAL FOR BREAST CANCER**TML Andersson**¹, MJ Rutherford², K Humphreys¹¹Karolinska Institutet, Stockholm, Sweden; ²University of Leicester, Leicester, Great Britain

Temporal trends in relative survival ratios (RSR) can be useful for evaluating the impact of changes in cancer care on the prognosis of cancer patients, but their use is problematic for cancer sites where screening has been introduced due to the potential of lead-time bias. Lead-time is survival time that is added to a patient's survival time because of an earlier diagnosis irrespective of a possibly postponed time of death. In the presence of screening it is difficult to disentangle how much of an observed improvement in survival is real and how much is due to lead-time bias. Even so, RSRs are often presented for breast cancer, a site where screening has led to early diagnosis, with the assumption that the lead-time bias is small.

We have performed a simulation study of mammography screening and breast cancer incidence and survival, based on a natural history model developed in a Swedish setting. Screening every second year among ages 40-75 was introduced assuming that screening had no effect on survival, except for lead-time bias. Relative survival was estimated both with and without screening, where the difference between the estimates was due completely to lead time, to enable quantification of the lead-time bias.

Scenarios with low, moderate, and high breast cancer survival, as well as low, moderate and high screening sensitivity were simulated, and the lead-time bias on estimates of 1, 5 and 10-year age-standardized RSRs for breast cancer were assessed in all scenarios. The lead-time bias was generally small, but the largest absolute bias was 5.7 percentage points and the largest relative bias was 8.4%, both observed for the 5-year RSR in the scenario of low survival and high screening sensitivity.

Publication: Andersson TM, Rutherford MJ, Humphreys K. Assessment of lead-time bias in estimates of relative survival for breast cancer. *Cancer Epidemiol.* 2016 Dec 24;46:50-56.

1E2

USING LOSS IN EXPECTATION OF LIFE TO FURTHER QUANTIFY POPULATION DIFFERENCES IN CANCER SURVIVAL**M Rutherford**¹, E Syriopoulou¹, H Bower², T Andersson², P Lambert^{1,2}¹University of Leicester, Leicester, Great Britain; ²Karolinska Institutet, Stockholm, Sweden

Background: Cancer survival estimates for different population groups are often expressed using relative survival, which is a useful metric for fair comparisons, but lacks easy interpretation. An alternative measure to quantify the impact of cancer is the average loss in life expectancy associated with a cancer diagnosis; the difference between the life expectancy in the general population to that in the cancer population.

Purpose: To exemplify the use of alternative metrics to express differences in cancer survival across population groups, and to show the population impact of differences in survival using more meaningful metrics.

Methods: The same modelling approach for calculating relative survival estimates across continuous age and deprivation group can be utilized to estimate average life years lost by making simple and sensible extrapolations of the long-term excess mortality. We will discuss the approach necessary to calculate the estimates and describe the advantages of reporting these additional metrics.

Results: The approach will be illustrated using English cancer patient data, highlighting how deprivation inequalities in survival can be reported using the average life years lost. Furthermore, the impact of removing inequalities can be understood by calculating the average gain in life years should socioeconomic differences in relative survival be removed. Socioeconomic differences generally result in higher early excess mortality for more deprived patients, impacting life expectancy. However, differences in population survival across socioeconomic groups also explain a large proportion of the deprivation gap for certain sites (e.g., breast cancer).

Conclusions: It is vital that a range of metrics are available to fully communicate the impact of a cancer diagnosis on patient prognosis. Using life years lost to quantify impact and for expressing the potential for population group improvements gives tangible and easily interpretable measures.

1E3

THE IMPACT OF INCLUDING HIGHER ORDER PRIMARIES IN SURVIVAL ANALYSES: ONTARIO, CANADA

D Nishri¹

¹Cancer Care Ontario, Toronto, Ontario, Canada

Traditionally, the survival analysis of population-based cancer registry data was restricted to first primary cancers only. However, a new registry may mistake a second or higher order cancer for the first primary because information about previous cancers is not available. The Ontario Cancer Registry (OCR) has incidence data from 1964, but its complex, conservative multiple primary rules restricted the number of higher order primaries registered.

In 2010, the OCR adopted the NAACCR Multiple Primary rules, bringing its counting rules into line with the rest of North America. It is now possible to examine the impact of including higher order primaries on survival before and after the rule change (2005-2009 vs. 2010-2014). For these analyses, the cancers selected were those being studied in the International Cancer Benchmarking Partnership's SurvMark-2 project: colon, esophagus, liver, lung, ovary, pancreas, rectum and stomach cancers. In 2005-2009, the percentage of additional cases added by including higher order primaries ranged from 7.2% (pancreas) to 15.0% (esophagus); these percentages doubled for most cancers in the later time period, ranging from 17.9% (rectum) to 30.6% (esophagus).

Preliminary survival analyses show that the inclusion of higher order primaries has a small effect in the earlier time period, with the largest relative decrease observed for esophagus (16.6% vs 16.2%). Larger decreases were found in the second-time period, with the largest relative decrease observed for liver (25.0% vs 23.2%). The inclusion of extra pancreatic cancers had no effect on survival for either period. It does not appear that Ontario's multiple primary rules are a major factor in explaining Ontario's high liver and pancreatic cancer survival.

1E4

IMPACT AND IMPLICATIONS OF CANCER DEATH STATUS REPORTING DELAY ON RELATIVE SURVIVAL ANALYSIS WITH PRESUMED-ALIVE ASSUMPTION

X Dong¹, Y Ren¹, R Wilson², K Zhang¹

¹ICF Inc., Fairfax, VA, United States; ²Centers for Disease Control and Prevention, Atlanta, GA, United States

Background: Death status reporting delay occurs when the death information of a cancer patient is not reported to a national cancer surveillance program in the same year the death occurred. The death status can be reported to the registry many years after the year of death. The presumed-alive assumption in cancer survival analysis may regard these dead patients as alive, which may create an overestimation bias in relative survival analysis.

Purpose: The first goal is to understand the patterns of death status reporting delays in the NPCR data, while the other goal is to establish a methodology to quantify the overestimation biases in relative survival caused by death status reporting delay without the interference of incidence reporting delays.

Methods: The study used the NPCR November submissions between 2001 and 2014 from 16 states, whose data quality met the standards for USCS and relative survival calculations. A customized NPCR SAS Tool was used to estimate relative survivals by tracking a cohort of cases from Submission 2009 to 2014 with the vital status as the sole confounding factor. The NCHS decennial and annual complete life tables 2000-2012 was used to calculate expected survival with the Ederer II method.

Results: How death status reporting delays impact survival time with the presence of presumed-alive assumption will be explained. The preliminary evaluation of relative survival results showed that the delays could cause overestimation biases, though site specific: All-sites-combined 0.9%, colon and rectum 1.0%, female breast 0.0%, brain and other CNS, 1.2%, pancreas 1.3%.

Implications: Our previous study indicated that incidence reporting delay incurred underestimation of relative survival with presumed-alive assumption. The apparent conflict of biases between death status reporting delay and incidence reporting delay suggests that a thorough study is needed to understand the interactions of these two delays on the relative survival with presumed-alive assumption in population-based cancer survival studies.

F Student Presentations I

10:30am - 12:00pm

1F15

THYROID CANCER IN NEW MEXICO: TIME TRENDS AND SURGICAL TREATMENT PREFERENCES, 1981-2013

I Mahdi¹, A Meisner¹, C Wiggins¹

¹New Mexico Tumor Registry, Albuquerque, NM, United States

Background: Thyroid cancer incidence rates are increasing both nationally and internationally, with substantial costs, financial and otherwise, for individuals and health care systems. Thyroid cancer trends in New Mexico (NM) have not been critically assessed since 1996.

Purpose: This epidemiological study describes time trends in thyroid cancer incidence rates in NM using data from the population-based New Mexico Tumor Registry. The study also documents the concomitant choices of surgical treatment and its public health impact.

Methods: Average annual age-adjusted incidence rates (per 100,000) were calculated by direct method and were adjusted to the 2000 U.S. standard population. Temporal changes in incidence rates were evaluated for the time period 1981-2013 using joinpoint regression. Trends in cancer-directed surgery were also assessed.

Results: Thyroid cancer incidence rates increased dramatically during the study period in all racial/ethnic groups. Among papillary tumors, the most common and least aggressive form of the disease, temporal increases were observed for all tumor size categories: 1 cm or less (annual percent change [APC], 1988-2003=9.0 [95% Confidence Interval (CI)=6.9,11.3], and APC, 2003-2013=3.2 [95% CI=0.9,5.5]), 1.1-2 cm (APC, 1988-2013=5.3 [95% CI=4.3,6.3]), 2.1-5.0 cm (APC, 1988-2013=3.7 [95% CI=2.9,4.4]), and greater than 5 cm (APC, 1988-2013=5.6 [95% CI=3.2,8.0]). Total thyroidectomy was the most common surgical procedure, regardless of the tumors size and histological variety. Even among Papillary tumors measuring less than 1 cm, total thyroidectomy increased from 57% of patients in 1998 to 84% of patients in 2013.

Conclusion: Thyroid cancer rates increased among all racial/ethnic groups in NM and the increase may not be solely attributable to overdiagnosis. Further, a majority of patients were being treated with the most extensive surgical options regardless of the tumor's size and histology, at considerable cost to patients and health care systems.

IF25

ANALYSIS OF BREAST CANCER TREATMENT DELAYS IN NEW JERSEY PATIENTS

K DeMair^{1,2,3}, A Stroup^{1,2,3}, J Tsui², E Marshall², D Rotter², J Li², D Moore^{1,2}, N Herman², K Demissie^{1,2}, C Lozada², G Lu-Yao⁴

¹Rutgers School of Public Health, Piscataway, NJ, United States; ²New Jersey State Cancer Registry, New Brunswick, NJ, United States; ³Rutgers Cancer Institute of New Jersey, New Brunswick, NJ, United States

Purpose: Treatment delay has been shown to be associated with increased mortality, yet the risk factors that affect treatment delay are not well understood. This study aims to identify factors associated with breast cancer patients' delays in treatment so that researchers may be better able to identify options to reduce delays and improve the overall health of breast cancer patients.

Methods: New Jersey State Cancer Registry (NJSCR) records were used to identify 1,356 patients diagnosed with stage I, II, or III breast cancer between 2012 and 2014. Patients were mailed surveys in English and 304 were included in the final sample. Multiple demographic, socioeconomic, and overall wellness characteristics were reviewed to investigate associations with treatment delay. Treatment delay was defined as the length of time from date of diagnosis to date of first treatment, using 60- and 90-day benchmarks.

Results: In logistic regression analysis, factors which indicated increased odds of delay >60 days were non-Hispanic black race (OR=3.06, 95% CI 1.12-8.37), lack of primary insurance (OR=5.07, 95% CI 2.35-10.96), or Medicaid as primary insurance (OR=2.90, 95% CI 1.39-6.05) when adjusted for age, stage, primary insurance, and type of first treatment. These were also significant risk factors for delay >90 days. Being married with children under 19 years old was associated with higher odds of delay >60 days in an expanded adjusted model compared to being a married woman without children (OR=3.23, 95% CI 1.37-7.61).

Conclusion: A majority of the women in this study received timely treatment. Our results agreed with previous studies of treatment delay that race and ethnicity and insurance status are key risk factors. The significance of family structure should be studied further since it was new to this study and has not been widely discussed in the literature.

1F3S

INITIAL SYSTEMIC TREATMENT IN STAGE IV NON-SMALL CELL LUNG CANCER (NSCLC), CALIFORNIA 2012-2014

F Maguire^{1,2}, C Morris¹, A Parikh-Patel¹, K Kizer¹

¹Institute for Population Health Improvement, University of California Davis Health System, Sacramento, CA, United States; ²University of California Davis, Graduate Group in Epidemiology, Davis, CA, United States

Background: NSCLC is often diagnosed at stage IV when it has a median survival of 4 to 5 months. Systemic treatments, chemotherapy, and targeted medications are the mainstays of treatment for advanced NSCLC. Targeted medications for NSCLC are being developed and approved for treatment at a rapid rate, but their use in the general population is unknown.

Purpose: To describe the utilization of initial systemic treatments (chemotherapy, targeted treatment) in Californians with stage IV NSCLC and characteristics (patient age, race/ethnicity, type of health insurance) of persons undergoing these treatments.

Methods: All cases of stage IV NSCLC diagnosed in California from 2012 to 2014 were identified from the California Cancer Registry. Systemic treatment information was discerned from text fields. Logistic regression was used to assess the association between treatment type and patient characteristics.

Results: Nearly half (48%) of the 17,357 people with stage IV NSCLC did not receive any systemic treatment. Use of targeted therapy increased each year from 2012 to 2014. There were differences in the use of systemic treatments by patient age, race/ethnicity, and health insurance type.

Conclusions: Cancer registry data can be used to describe the utilization of new treatments in all patient types. Identified disparities can inform clinicians that not all patients are benefiting from available treatments. This study lays the groundwork for a future study on survival by treatment type in a real world setting that includes all patient types.

1F4S

EXCESS TREATMENT-RELATED INCIDENCE OF DISEASES OF THE CIRCULATORY SYSTEM IN PATIENTS DIAGNOSED WITH HODGKIN LYMPHOMA

CE Weibull¹, PC Lambert^{1,2}, M Björkholm³, I Glimelius^{4,5}, TML Andersson¹, PW Dickman¹, S Eloranta⁴

¹Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden; ²Biostatistics Research Group, Department of Health Sciences, University of Leicester, Leicester, Great Britain; ³Division of Haematology, Department of Medicine, Karolinska University Hospital, Stockholm, Sweden; ⁴Department of Medicine Solna, Clinical Epidemiology Unit, Karolinska Institutet, Stockholm, Sweden; ⁵Department of Immunology, Genetics and Pathology, Experimental and Clinical Oncology, Uppsala University, Uppsala, Sweden

Background: Hodgkin lymphoma (HL) survival has improved considerably over the last 40 years and recent focus has been on understanding and reducing long-term treatment-related morbidity and mortality. Eloranta et al.¹ studied trends in excess treatment-related *mortality* of diseases of the circulatory system (DCS) in HL patients, and quantified the burden of such deaths in relation to deaths from the underlying disease and other (non-HL) related causes of death, using methods from competing risks in a relative survival framework. They observed a reduction in excess DCS mortality over time, and predicted that the absolute risk of dying from treatment-related DCS was low in relation to the risk of deaths from competing causes within the first 20 years after diagnosis.

Objective: Our aim was to study temporal trends in excess *incidence* of treatment-related DCS among HL patients.

Material and Methods: We utilized several population-based registers, including the Swedish Cancer Register and the National Patient Register. Using competing risks methods within a relative survival framework, we estimated excess incidence of DCS. Modelling was done using flexible parametric models. Crude probabilities of DCS over time since diagnosis were calculated by creating a user-written Stata command.

Results: The analyses are ongoing, and only preliminary results are available at this stage. Results will be presented at the meeting.

Significance: We hope to disentangle whether the burden of treatment-related disease has truly decreased, or if the decrease in excess DCS mortality is mainly attributable to improved management of DCS.

Reference: ¹Eloranta, S. et al. Temporal Trends in Mortality From Diseases of the Circulatory System After Treatment for Hodgkin Lymphoma: A Population-Based Cohort Study in Sweden (1973 to 2006). *J Clin Oncol*, 2013. 31(11): p. 1435-1441.

IF5S

J Clerville¹, S Bolick², S Clugstone²

¹FULBRIGHT, Cambridge, United States; ²South Carolina Department of Health and Environmental Control (Central Cancer Registry), Columbia, United States

Background and Objectives: Over the last decade, several researchers have found an increase in the rate of contralateral prophylactic mastectomy across the United States despite the limited evidence on survival improvement associated with this surgery. Information on contralateral prophylactic mastectomy in South Carolina was unknown. We evaluated the trends of different breast cancer surgery types and emphasized the contralateral prophylactic mastectomy trends and rates in South Carolina from 2005 through 2013.

Methods: We conducted a descriptive analysis of contralateral prophylactic mastectomy among South Carolina women who underwent surgery for breast cancer, from 2005 through 2013, and compared its trend over time with other type of surgeries performed. We used the data from the South Carolina Central Cancer Registry, a population-based cancer registry, to carry out our analysis.

Results: We found that 1,587 (4.66%) women who were surgically treated for breast cancer underwent contralateral prophylactic mastectomy. The overall rate increased from 3.03% in 2005 to 5.25% in 2013. Among Whites, the rate increased from 2.75% to 4.24%, and among Blacks, it increased from 0.18% to 0.92%. Among non-Hispanics, the contralateral prophylactic mastectomy rate increased from 2.94% in 2003 to 5.08% in 2013, representing 97.3% of the total number of CPMs performed. Meanwhile, the unilateral mastectomy rate decreased from 23.62% in 2005 to 17.97% in 2013. The breast-conserving surgery rate was steady.

Conclusion: Overall, the contralateral prophylactic mastectomy rate increased in South Carolina for the period 2005-2013 among Black, White, and non-Hispanic Women. Further research should assess the risks factors for contralateral prophylactic mastectomy among females diagnosed with breast cancer.

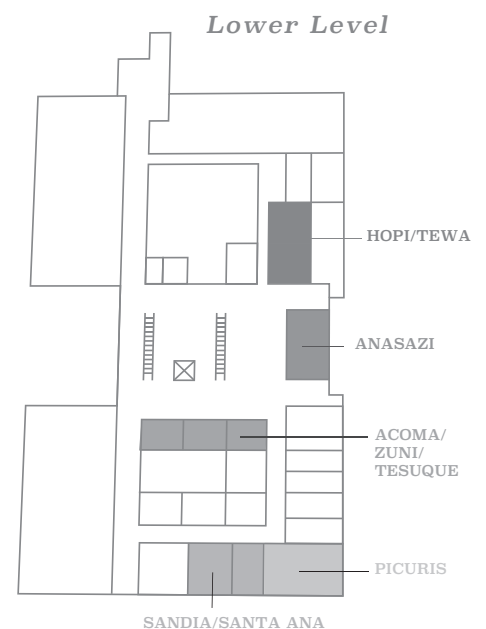
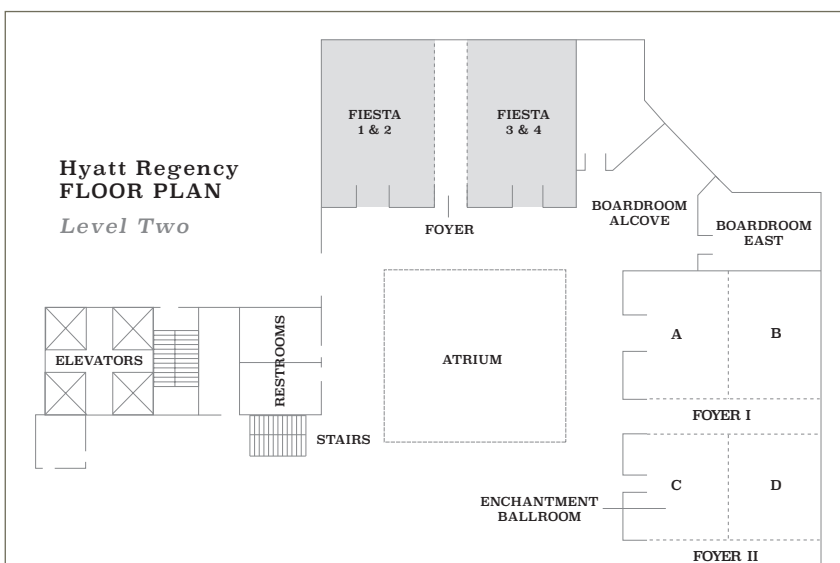
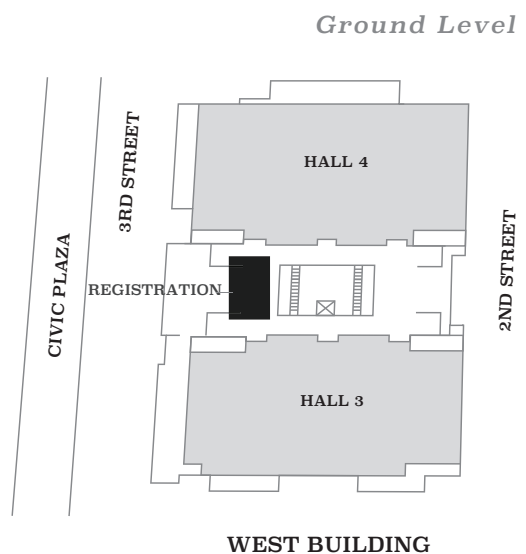
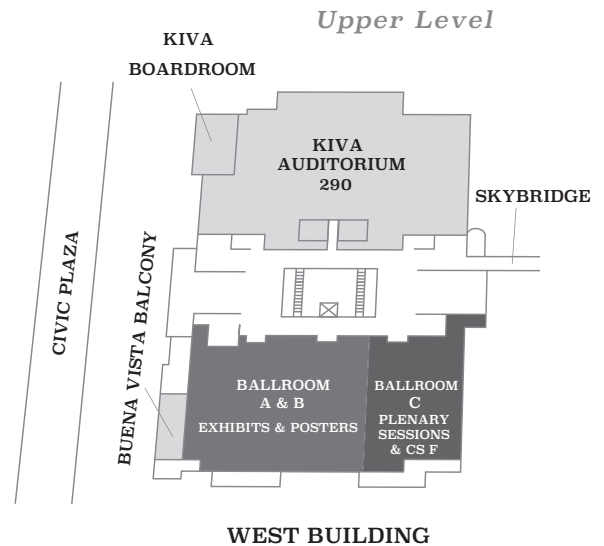
Floor Plans

Please note: All rooms are located in the Albuquerque Convention Center unless otherwise indicated.

Albuquerque Convention Center

- **Registration: Ground Level**
- **Plenary Session & Concurrent Session F: Ballroom C**
- **Exhibits/Breakfast/Posters: Ballroom A&B**
- **Concurrent Session A: Hopi/Tewa**
- **Concurrent Session B: Anasazi**
- **Concurrent Session C: Acoma/Zuni/Tesuque**
- **Concurrent Session D: Sandia/Santa Ana**
- **Concurrent Session E: Picuris**

Albuquerque Convention Center FLOOR PLAN



A Registry of the Future

1:30pm - 3:00pm

2A1

WE NEED TO TALK ABOUT RECURRENCE: HOW CAN WE IDENTIFY PATIENTS WITH PROGRESSIVE CANCERS WHEN WE CANNOT EVEN AGREE ON DEFINITIONS?

J Charnock^{1,2}, L Elliss-Brookes¹, G Lyratzopoulos^{1,2}

¹National Cancer Registration and Analysis Service, Public Health England, London, Great Britain; ²Macmillan Cancer Support, London, Great Britain

Background: As cancer treatments and survival improve there has been a growing interest in the relapse and recurrence of the disease. The time between treatment and relapse is becoming an increasingly important measure of the success of initial treatments and the quality of life of those living with and beyond cancer. The collection of recurrence data is challenging; not least as there are many different ways in which patients may re-present, not all of them through secondary care and often many years after their initial successful treatment. The National Cancer Registration and Analysis Service (NCRAS) in Public Health England has committed to improving data collection on these patients.

Challenges: Current literature is inconsistent in the description and definition of recurrence, metastasis, and subsequent primary cancers. What is relevant clinically in terms of recurrence will be different for different cancers. Where data items have been defined, hospitals have not been good at submitting recurrence data; we have no denominator readily available to assess the total number of recurrences we would expect to be reported. Current workflows in registration mean that recurrence records even when sent by hospitals may not necessarily get linked to the tumor.

Analytical approach to recurrence quantification: While there may not always be a definitive record of when a patient's cancer has relapsed, the rich data sets that NCRAS collects on each patient should contain sufficient information to allow us to infer that relapse has occurred. For example, we may be able to identify a cluster of imaging investigations or a change in medication that is suggestive of relapse. Repeat courses of chemotherapy and radiotherapy would be highly suspicious that relapse has occurred. This approach will be tested for a small patient cohort (stage 3 colon cancer) and the results used to predict the number of recurrences in the population.

Results: To be presented in June.

2A2

OPPORTUNITIES FOR CONNECTED HEALTH RESEARCH AND INTERVENTIONS THROUGH NCI SEER AND THE FCC BROADBAND MAPPING TOOL

C Lam¹, Y Shaikh², J Boten¹, C Gibbons², B Hesse¹, D Ahern¹, D Stinchcomb³, Z Tatalovich¹, P Fearn¹

¹National Cancer Institute, Rockville, MD, United States; ²Federal Communications Commission, Washington, DC, United States; ³Westat, Rockville, MD, United States

Background: The National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) program provides cancer statistics and surveillance information in an effort to reduce the cancer burden in the United States. The Federal Communications Commission (FCC) creates publically available data and tools, such as the Broadband Mapping Tool, that characterize the geography of broadband access to the internet in the U.S. Recent national health initiatives have focused on the development and use of technologies to promote cancer prevention, enhancing the experience of cancer care for patients and care teams, and accelerating progress in cancer research. The NCI/FCC collaboration provides opportunities to study the relationship between the relative digital connectedness of populations and their various cancer diagnosis, treatment trajectories, and outcomes.

Purpose: We plan to educate registries and researchers about these resources to stimulate new avenues of population-based research. Overlaying broadband data with cancer surveillance data could enable evaluations of the relations between internet connectivity, access to information and care, and disparities in outcomes.

Methods: We will provide an overview of the FCC Broadband Mapping dataset and tools overlaying with cancer surveillance data to show possible health disparities associated with broadband access. We will also highlight other potential FCC/central cancer registry partnerships.

Results: Based on preliminary analysis of these combined datasets, we will discuss possible research questions, opportunities for registries and researchers, and potential interventions from the FCC.

Conclusions: This NCI/FCC initiative illustrates the value of data sharing and collaboration across agencies to leverage technology and publically-available data sets for cancer prevention, surveillance, and control.

2A3

TOWARDS AN INTEGRATION OF THE GENOME AND EXPOSOME WITH CANCER REGISTRY DATA

G Jacquez¹

¹BioMedware, Ann Arbor, MI, United States; ²University at Buffalo, SUNY, Buffalo, NY, United States; ³University of Michigan, Ann Arbor, MI, United States

To what extent should cancer registries be integrated with individual-level data on the human exposome and genome? This presentation will explore this question within the framework of an ongoing contract from the National Cancer Institute's "METRIC Software to Measure Cancer Health Environments" and a research proposal (in development) — "HEO: Human Exposome Observatory." Does the future of cancer registries include the provision of individual-level cancer data with a person's exposome history and genome?

2A4

UPDATING VOLUME V FOR THE REGISTRY OF THE FUTURE TNVVR Task Force (TF)¹

¹North American Association of Central Cancer Registries, Inc., Chicago, IL, United States

Background: Revision of NAACCR Standards Vol V (NV5) is in progress. This standard provides specifications for electronic transmission of cancer information from pathology laboratories to cancer registries. It is equipped to capture pathology report information, in either narrative text format or structured path reports using the College of American Pathologists (CAP) electronic Cancer Checklist templates. Recent collaborative projects with CDC, CAP, ASCO, ONC and the California Cancer Registry have offered solutions to workflow problems related to transmission of pathology information, including biomarker data. However, the rapid development in molecular diagnostic (and prognostic) testing remains a current and future challenge to the cancer surveillance and research community. In particular, labeling and patient/specimen identification (e.g., using a unique specimen ID) is required for transmission, tracking, storage, and retrieval of specimen information. A unique centralized specimen ID that follows the specimen from one institution to another would facilitate better specimen data integrity and quality, enabling automated cancer case and tumor consolidation. Current industry practices lack such a standardized and centralized tracking system for tumor specimens.

Purpose: The purpose of the NV5 Revision TF is to provide updated specifications for electronic pathology reporting and assure the collection of reliable, accurate, and timely pathology reports.

Methods: The TF agreed to monthly conference calls. Solutions from pilot projects contributed to updated work-flow models, such as the Multi-Site Specimen Process Flow Model. These models will be accompanied by use-case scenarios and HL7 sample messages.

Results: The new NV5 will offer timely solutions to current issues, such as those related to the capture of genomic and genetic information, including specimen ID transmission.

Conclusions: Highlights of the updated NV5 will be presented, as will challenges.

B Cancer in Native Peoples

1:30pm - 3:00pm

2B1

IMPROVING AMERICAN INDIAN AND ALASKA NATIVE CANCER AND MORTALITY SURVEILLANCE DATA**M Jim**¹, D Haverkamp¹, C Jim², S Melkonian¹, D Espey¹¹Centers for Disease Control and Prevention, Albuquerque, NM, United States; ²IHRC, Inc., Albuquerque, NM, United States

In 2010, an estimated 5.2 million people reporting American Indian/Alaska Native (AI/AN) ancestry alone or in combination with one or more races lived in the U.S., representing approximately 1.7% of the population. These communities have diverse languages, cultures, and histories. The Indian Health Service (IHS) provides primary health care to approximately 2.2 million enrolled members of 567 federally recognized tribes. Misclassification of AI/AN as non-AI/AN in cancer incidence and vital statistics data has resulted in the underestimation of the disease burden in these populations. Linkages of IHS patient registration data and data from central cancer registries that are part of the Centers for Disease Control and Prevention's National Program of Cancer Registries (NPCR) and the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (SEER) provided evidence that, when reporting national rates, the regional variations were masking the real burden of disease among AI/AN. Similarly, a linkage of U.S. National Death Index records with IHS patient registration data showed that the disparity in death rates between AI/AN and non-Hispanic white populations in the U.S. remain large for most causes of death. The results from the IHS linkages have been used to provide the most accurate data available in numerous peer-review and tribal publications. Tribal linkages to further address race misclassification will also be presented.

2B2

POTENTIALLY PREVENTABLE CANCERS AMONG ALASKA NATIVE PEOPLE**S Nash**¹, E Provost¹¹Alaska Native Tribal Health Consortium, Anchorage AK, United States

Background: Cancer is the leading cause of death among Alaska Native (AN) people. AN tribal health leaders and researchers have expressed interest in understanding the cancer burden attributable to modifiable risk factors among AN people.

Objective: This study analyzed the prevalence of modifiable risk factors for cancer among AN people, including obesity, smoking, physical inactivity, and alcohol use. We also estimated the proportion and number of cancers potentially attributable to these risk factors.

Methods: Prevalence estimates for the modifiable risk factors were assessed using data from the Alaska Behavioral Risk Factor Surveillance Survey (AK-BRFSS). We examined incidence of 18 tobacco, physical inactivity- or alcohol-related cancers using data from the SEER Alaska Native Tumor Registry. Population attributable risk (PAR) was calculated for each risk factor and cancer site using Levine's formula. Number of potentially preventable cancers was estimated based on the number of cases diagnosed during the most recent five-year period (2010-2014).

Results: Incidence of smoking-, obesity-, physical inactivity-, and alcohol-related cancers varied by site, but was highest for cancers of the breast, lung, and colon/rectum. PAR varied by site and risk factor, but was highest for lung cancer and smoking, with an estimated 78.8% cancers among males, and 69.8% among females attributable to this risk factor.

Conclusions: Smoking remains a key primary prevention target for reducing the burden of cancer and other chronic diseases among Alaska Native people; smoking prevalence among AN people is twice as high as that reported among U.S. whites. However, obesity, physical activity, and alcohol use may also account for a varying, but substantial proportion of cancers among this population. Given the high burden of cancer in this population, a comprehensive, culturally appropriate approach to primary prevention is warranted.

2B3

A CANCER PROFILE FOR FIRST NATIONS IN ONTARIO ACHIEVED THROUGH LINKED REGISTRY DATA AND PARTNERSHIPS

S Jamal¹, M Prummel¹, A Yurkiewich², C Jones², D Nishri¹, J Walker³, D Henry³, A Kewayosh¹, A Sheppard^{1,4}, L Marrett^{1,4}

¹Cancer Care Ontario, Toronto, Ontario, Canada; ²Chiefs of Ontario, Toronto, Ontario, Canada; ³Institute for Clinical Evaluative Sciences, Toronto, Ontario, Canada; ⁴Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

Background: Information on cancer burden among Ontario's Aboriginal population is limited due to lack of ethnicity data in health databases.

Purpose: (1) Investigate the feasibility of a partnership combined with data governance and sharing agreements in providing useful cancer data to First Nations, and (2) estimate cancer burden in First Nations in Ontario from 1991–2010.

Methods: For over 6 years, researchers from Cancer Care Ontario and the Institute of Clinical Evaluative Sciences have partnered with the Chiefs of Ontario and First Nations to work towards building a strategy to track cancer patterns in First Nation communities. The partnership and underlying strategy involved linking the Indian Registry System (includes registered First Nations) to the Registered Persons Database (includes information on people with Ontario health insurance coverage) and the Ontario Cancer Registry using deterministic and probabilistic methods. Age-standardized estimates of cancer burden (incidence, mortality, survival and prevalence) were calculated for First Nations and other Ontarians.

Results: Compared to other Ontarians, First Nations had significantly lower incidence of prostate, female breast and brain cancer, but significantly higher incidence for colorectal, lung, kidney and cervical cancer. Incidence of cervical and male lung cancer declined significantly from 1991–2010. Five-year observed survival was poorer in First Nations compared to other Ontarians for cancers of the cervix and male lung. Over time, observed survival in First Nations improved for breast and prostate cancers.

Conclusion: This work demonstrates that our collaboration and adherence to certain principles can produce information on cancer burden for First Nations in Ontario. Although cancer rates in First Nations may be increasing, decline in cervical and male lung cancer show progress. Continued partnership work will enable further development of cancer control.

2B4

CHOICE OF RELATIVE OR CAUSE-SPECIFIC APPROACH TO CANCER SURVIVAL ANALYSIS IMPACTS ESTIMATES DIFFERENTIALLY BY CANCER TYPE, POPULATION AND APPLICATION: EVIDENCE FROM A COMPARISON OF FIRST NATIONS AND NON-ABORIGINALS IN CANADA

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Background: Cause-specific (CS) and relative survival (RS) are the two most common methods for estimating net cancer survival. We compared two permutations of each CS and RS approaches using data from First Nations and non-Aboriginal populations in Canada to determine the impact of each method on the results.

Methods: Subjects were members of the 1991 Canadian Census Mortality Cohort, a population-based cohort of adult respondents to the 1991 Long Form Census who have been followed up for cancer and death through linkage to administrative databases. We compared four methods: relative survival analyses with ethnicity-specific life tables (RS-ELT); relative survival with general population life tables (RS-GLT); cause-specific survival with a broad definition of cancer death (CS-Broad), and cause-specific survival with a narrow definition of cause of death (CS-Narrow).

Results: Except for breast and prostate cancers, RS-ELT, RS-GLT and CS-Broad tended to produce similar estimates of age-standardized five-year survival, whereas CS-Narrow yielded higher estimates of survival. RS-GLT-based estimates of the differences in survival between First Nations and non-Aboriginals were higher than RS-ELT estimates, and the CS estimates tended to be lower than RS estimates. The differences between the four methods were most notable for breast and prostate cancers, and for cancers of the digestive and respiratory tract.

Conclusion: The method employed influenced both the estimates cancer survival in a single population and, to a lesser extent, estimates of disparities in survival between populations. The differences between estimates were greatest for breast and prostate cancers, two of the most common cancers. This comparison provides insight into the empirical effects of the theoretical biases associated with four of the most common methods for estimating net cancer survival and can contribute to more informed interpretation of survival and survival disparity estimates in these and other populations.

2C1

PHYSICIAN MEDICAL CLAIMS REPORTING IN FLORIDA

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Background: The Florida Cancer Data System (FCDS) began the physician reporting initiative through medical claims in 2011. Since then, the FCDS has developed a system for automating claims processing, which leverages multiple sources of medical information, including pathology and hospital reporting. The consolidation of these data sources enables the identification of new cancer cases as well as capture of more complete treatment information.

Methods: The FCDS claims team developed an automated system that crosswalks claims data elements into a standard and consolidated NAACCR abstract. The resulting claims abstracts are linked against all registry source information for enhancement and validation of data. Specifically, the FCDS developed a system called the Claims Abstract Pathology Integration System (CAPIS) that links claims-abstracts to pathology reports, which uses natural language processing to capture primary site diagnosis and histology. These are then visually reviewed by staff to determine new cases, histologic type, and to resolve edit issues. Additionally, the FCDS uses Lexis/Nexis to validate Florida residency of new cases.

Results: For 2014 diagnosed cases alone, over 20,000 new cases have been identified using claims and pathology reporting. The top five cancer sites from this group are made up of prostate, breast, bladder, lung, and hematopoietic cancers. Verification of residence at time of diagnosis will determine final integration of the new record into the registry database. Additional claims records are used for treatment augmentation and dates of last contact.

Implications: Quality control of physician medical claims requires the development of new business practices and methodologies for accurate tumor linkage and data capture. These novel procedures serve to maximize automation and reduce the need for visual review by taking into consideration all the caveats of claims data while leveraging multiple data sources and verification systems.

2C2

OCCUPATIONAL CANCER SURVEILLANCE IN THE AGE OF RESTRICTED IDENTIFIER ACCESS: A LINKAGE OF FLORIDA CANCER DATA SYSTEM (FCDS) DATA WITH FIREFIGHTER CERTIFICATION RECORDS

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Background: The quality of cancer registry linkage is influenced by the availability and completeness of key identifiers, especially social security (SS) number. Firefighter certification records in Florida were obtained to perform a record linkage; however, release of SS number was restricted by state statute. Additionally, early certification records often contained incomplete information.

Purpose: To describe an initial attempt at record linkage and current activities designed to create a more comprehensive record linkage file for a specific workforce.

Methods/Results: The certification data file contained 101,542 firefighter records. Of these, 81,554 records contained a valid birthdate; there were over 22,000 records with no gender. A manual review of first names was performed on records with a valid date of birth in order to assign gender. All but 174 records with gender-ambiguous names were assigned a proxy gender value. A deterministic match with FCDS data (1981-2013) using first name, last name, date of birth, gender, state, county, and city (based on home address), resulted in just 53 tumor record matches. This is a fraction of the true number of Florida firefighters with cancer, given that a previous automatch linkage study using the same certification database, (which included SS number), resulted in the identification of over 1,000 firefighter cancer cases (*J Occ Environ Med* 2006; 48:883-8). After obtaining state approvals, we are employing Lexis Nexis software to conduct a batch look-up of missing SS number, date of birth, and gender in order to re-run the linkage.

Conclusions: Lexis-Nexis software may be used to both augment data fields and add missing SS number. However, this is an expensive option (up to \$40,000) that is not expected to return all identifiers. Policy efforts to secure legislation permitting restricted release of SS number for research purposes is necessary to lower barriers to occupational cancer surveillance efforts.

2C3

PROGRESS UPDATE ON ELECTRONIC CANCER REPORTING THROUGH MEANINGFUL USE AT THE NORTH CAROLINA CENTRAL CANCER REGISTRY.

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Background: Reporting using MU2 Cancer Reporting must meet the data quality standards required for reporting to the NC-CCR. Using the Clinical Document Architecture (CDA) format is required for the MU2 incentive, but the format and content must also meet the requirements of NC-CCR before approval may be given. Certain fields are required in the CDA document to pass the quality assurance review. Following the successful submission of a test CDA document, EPs must also pass quality assurance testing before actual production and submission can occur.

Purpose: This presentation will outline some of the approaches taken by the NC-CCR to on-board physicians for Meaningful use stage 2 cancer reporting, some of the challenges, successes and lessons learned.

Methods: NC-CCR has followed a data validation process with a variety of methods including physician walkthroughs, collaborating with other registries, EHR vendors and CDC, and utilizing a physician reporting dashboard, etc.

Results: The NC-CCR MU2 team is receiving complete data from six physician offices.

Conclusions: Following a structured and detailed plan for data quality is a viable way to increase the data completeness. Building on successes and overcoming some of the challenges has been the key to improving the data quality of electronic cancer cases received from physician offices.

2C4

HOW STAGE DATA COLLECTED FROM CANCER CENTRES IS USED BY THE ONTARIO CANCER REGISTRY (OCR), COMPARED TO CANCER CARE ONTARIO'S (CCO) CORPORATE AND CULTURAL ASSUMPTIONS OF ITS VALUE, AN ENVIRONMENTAL SCAN

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This project is an examination of a unique jurisdictional strategy that captures stage information where hospital cancer registries are not prevalent. Ontario has only one hospital cancer registry but over 100 hospitals and 14 regional cancer centers (RCCs). RCCs provide radiation treatment, consultations and systemic therapy. CCO stage capture consists of OCR staff staging of all breast, lung, colorectal and cervical cases. The one other source of staging is RCC records required for CCO funded treatment. The quality RCC staging is not known. RCC stage is thought essential by some CCO programs and non-essential by others. Extent of use—internal and external—is not well documented.

Background: Current use of RCC-submitted staging for CCO business purposes. If alternate sources of cancer center stage are used by CCO. The perceived quality and timeliness of RCC stage as a barrier to use. Examine the CCO mandate of complete population staging in relation to CCO corporate goals. Clarify the assumption that RCC stage capture is necessary to achieve population staging.

Methods: An internal and (local) external environmental scan with Likert-type survey, followed by in-depth interviews at the VP, director, manager and subject expert levels, including healthcare, surveillance, research, policy, funding, and data analysts. Externally, researchers and Public Health units. The interview consists of open-ended questions appropriate to the position of the interviewee, covering the topics above.

Outcomes Presented: A more accurate determination of business uses of RCC stage data and if alternative sources are used. If RCC stage quality drives negative decisions about use, it presents opportunity to consider improving or curtailing these data. Establish CCO corporate concordance whether population level staging is essential to its goals. Once the alignment is clear, the role of RCC staging in population-level staging can be determined.

2D1

LATEST TRENDS IN THYROID CANCER INCIDENCE IN FEMALES BY RACE/ETHNICITY IN THE UNITED STATES AND LOS ANGELES COUNTY

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Background: Thyroid cancer has been increasing worldwide over the past few decades in all racial/ethnic groups and is considered to be the most rapidly increasing cancer in the United States. Increased detection due to more sensitive diagnostic procedures may be contributing to the rise in incidence, and possibly resulting in over diagnosis. Some recent reports suggest stabilization of incidence rates in recent years, reflecting changes in guidelines and clinical practices. Risk factors for thyroid cancer include being female, having a history of thyroid nodules or goiter, having a family history of thyroid cancer, genetic conditions that raise the risk of thyroid cancer, and exposure to radiation. Most thyroid cancers are highly curable and have high survival rates. However, long-term health effects from overdiagnosis and overtreatment remain a concern.

Purpose: This study will describe thyroid cancer incidence trends by race/ethnicity nationwide and in the diverse population of Los Angeles County.

Methods/Approach: Surveillance, Epidemiology, and End Results Program (SEER) and California Cancer Registry (CCR) data will be analyzed to identify thyroid cancer incidence trends in females by race/ethnicity over time and in comparison with data collected by the International Association of Cancer Registries (IACR) wherever possible.

Results: The most recent registry data will be presented.

Conclusions/Implications: This study will present trends from the global, United States, and Los Angeles perspectives. Findings will provide information to help determine whether long-standing thyroid cancer incidence patterns are changing amongst historically high-risk populations and explore possible reasons for either the continued increase or possible stabilization in incidence. The lifelong consequences of overdiagnosis and overtreatment will be discussed.

2D2

TRENDS IN INCIDENCE, MORTALITY, AND SURVIVAL OR KIDNEY CANCER IN ONTARIO, 1981–2012

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¹Cancer Care Ontario, Toronto, Canada

Background: Kidney cancer is one of the fastest rising cancers worldwide. In Ontario, kidney cancer incidence rates have been increasing in both sexes since 1981. In 2012, there were 2,079 new cases of kidney cancer and 556 kidney cancer deaths in the province. Few studies have examined kidney cancer trends in Canada and until now, no studies have assessed these trends in Ontario.

Objectives: This study aims to examine trends in incidence, mortality, and survival for kidney cancer in Ontario by sex and subtype using data from the Ontario Cancer Registry. Projections will also be used to assess the future burden of kidney cancer in the province.

Methods: Trends over time will be analyzed by calculating the annual percent change (APC) in age-standardized rates using Joinpoint regression. Relative survival will be calculated using the Dickman algorithm and the Ederer II approach to expected survival. A Nordpred Power5 age-period-cohort model will be used to project incidence rates.

Results: Incidence and mortality rates over time will be presented for both sexes and by histology, highlighting the increasing trends in incidence and the decreasing trends in mortality. Projected incidence rates will also be presented up to the year 2030. Relative survival ratios will be presented by sex, age group, and histological subtype, and changes over time will be explored.

Conclusions: Kidney cancer incidence rates have been rising in Ontario since 1981 and are projected to continue to rise over the next two decades. This increase has been driven primarily by increases in the prevalence of modifiable risk factors, particularly obesity. Allocating future healthcare resources to prevention efforts may help to decrease the burden of kidney cancer in Ontario.



2D3

STOMACH CANCER TRENDS AND POTENTIAL RELATIONSHIP TO *H. Pylori*

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Background: Stomach cancer incidence and mortality decreased over the last century in the United States; however, stomach cancer is still the second leading cause of cancer death worldwide. *H. pylori* is a major risk factor for the development of cancer in the non-cardia regions of the stomach.

Purpose: Describe the descriptive epidemiology of stomach cancer in Tennessee.

Methods: Stomach cancers were obtained from the TN Cancer Registry for the period 2004-2013. Age-adjusted incidence rates were calculated for all stomach cancers stratified by histologic type, sex, and race. Annual percent changes (APC) were calculated.

Results: The stomach cancer rate in all races and sexes combined over the 10-year period was 6.78/100,000 and was increasing at a rate of 0.35%/annum. When stomach cancers were separated by topography, cancers of the non-cardia regions were found to be stable, whereas cancers of the cardia region demonstrated a statistically significantly increasing trend, APC = 4.33%/annum. Stomach cancers with topography NOS demonstrated a statistically significantly decreasing trend over the 10-year period, APC = -3.36%/annum. The significant increase in cancers of the cardia region observed for all races/sexes combined could be explained solely by a large increase of these cancers in white individuals, whereas in black individuals the rate was stable.

Conclusion: Stomach cancer incidence rates have declined in the United States for over a century. Recent trends indicate that stomach cancers appear to have stabilized, at least in Tennessee. The rate of stomach cancers affecting the cardia region, however, have been statistically significantly increasing in Tennessee over the 10-year period 2004-2013, and this increasing rate appears to be solely due to increases in the white population, whereas stomach cancers of the cardia region are stable in blacks. Possible correlation to changes in *H. pylori* prevalence will also be discussed.

2D4

INFERRING PROSTATE CANCER NATURAL HISTORY IN AFRICAN AMERICANS USING CANCER SURVEILLANCE MODELS

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Background: African American men have substantially higher prostate cancer incidence rates than the general population. The extent to which the incidence disparity is due to prostate cancer being more prevalent, more aggressive, and/or more frequently diagnosed in African American men is unknown.

Purpose: To estimate risks of prostate cancer onset, progression, and diagnosis in African American men and to evaluate the need for further research efforts into targeted screening in this population.

Methods: We estimated three independently developed models of prostate cancer natural history in African American men and in the general population using an updated reconstruction of PSA screening, based on the National Health Interview Survey in 2005, and prostate cancer incidence from the Surveillance, Epidemiology, and End Results program in 1975-2000. Using the estimated models, we compared prostate cancer natural history in African American men and in the general population.

Results: The models projected that 30-43% (range across models) of African American men develop preclinical prostate cancer by age 85 years, a risk that is (relatively) 28-56% higher than in the general population. Among men who have had preclinical disease onset, African American men have a similar risk of diagnosis (35-49%) compared with the general population (32-44%), but their risk of progression to metastatic disease by the time of diagnosis is 44-75% higher than in the general population.

Conclusions: Prostate cancer incidence patterns implicate higher incidence of preclinical disease and higher risk of metastatic progression among African American men. The findings support further research into the benefit-harm tradeoffs of more aggressive screening policies for African American men than for the general population.

E Survival Differences

1:30pm - 3:00pm

2E1

GLOBAL SURVEILLANCE OF CANCER SURVIVAL (CONCORD-3)

C Allemani¹, V Di Carlo¹, R Harewood¹, M Matz¹, M Nikšić¹, A Bonaventure¹, HK Weir², D Turner³, MP Coleman¹, C Working Group¹
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Background: In 2015, the CONCORD program established world-wide surveillance of population-based cancer survival trends, using data from 279 cancer registries on 26 million patients diagnosed 1995-2009 in 67 countries. CONCORD-3 will update cancer survival trends to 2014 for 15 malignancies: esophagus, stomach, colon, rectum, liver, pancreas, lung, melanoma of the skin, breast (women), cervix, ovary and prostate in adults (15-99 years), and leukemias, lymphomas, and brain tumors in both adults and children (0-14 years).

Methods: The CONCORD-3 database will include incidence and follow-up data from population-based registries in up to 70 countries for up to 30 million patients diagnosed with one of 15 malignancies during the 15 years 2000-2014. Standardized quality control procedures are applied to all data sets; errors are checked with the registry concerned. Net survival (i.e., the probability of surviving cancer after controlling for competing risks of deaths [background mortality]), will be estimated with the Pohar Perme estimator. To correct for background mortality, we will use life tables of all-cause mortality by single year of age, sex, and calendar year (and race) in each country or region. All-ages survival estimates will be age-standardized with the International Cancer Survival Standard weights.

Results: We will present preliminary results on worldwide patterns and time trends in estimates of net survival up to 5 years after diagnosis for adults diagnosed with one of these 15 malignancies during 2000-2014.

Conclusion: The survival estimates produced by the CONCORD program will be used in up to 70 countries in the evaluation of health system performance for the quality of cancer care. This will facilitate comparison of the overall effectiveness of health systems as a basis for informing national and global policy for cancer control.

2E2

POPULATION-BASED CANCER SURVIVAL IN CANADA AND THE UNITED STATES: COMPARISON BY SOCIO-ECONOMIC POSITION

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Background and Purpose: Results from CONCORD-2 showed that overall 5-year survival in Canada and the United States were comparable and among the highest in the world for patients diagnosed 1995 through 2009. Literature suggests a Canadian-advantage in survival among lower socio-economic (SE) groups and a U.S. advantage among higher SE groups. CONCORD-2 data from Canada and the U.S. are being used to explore this hypothesis.

Methods: Data for cancer patients diagnosed 2001-2009 were from 34 US statewide registries and 10 Canadian provincial registries. We estimated 5-year net survival for selected cancers by age, gender, calendar year, country, and neighborhood-level income quintiles (Canada) and county-level SES index (U.S.).

Results: In Canada, the survival difference between highest and lowest income quintiles are: 5.4% for ovarian cancer; 5.1% for female breast cancer; 4.3% for prostate cancer; 2.8% for lung cancer; and <1.0% for cancers of the stomach and cervix, and children with acute lymphoblastic leukemia. This analysis will be updated to include results from the U.S. and a comparison of results between Canada and the U.S.

Conclusions: Health care delivery differs between Canada and the United States. Exploring the relationship between SE position and population-based cancer survival may help inform cancer control efforts in both countries.

2E3

INTERNATIONAL CANCER SURVIVAL DIFFERENCES AND CANCER REGISTRATION PRACTICE IN ICBP JURISDICTIONS - QUANTITATIVE ANALYSIS

M Eden¹

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Background: International cancer survival comparisons often report differences in 1-year survival, which provide evidence that informs cancer control policies and clinical practice across a number of jurisdictions. One-year survival estimates are particularly sensitive to differences in cancer registration practice. Understanding how differences in cancer registration practice can impact on 1-year survival calculations is essential to interpreting this data.

Methods: We quantified the effect of differences in cancer registration practice (classification and coding, incidence date definition, recurrence recording, asymptomatic cancers) between jurisdictions using information from the key informant exercise and sensitivity analyses using a range of variables. Using this data we estimated the extent to which these differences affect 1-year survival calculations for all jurisdictions from ICBP Module 1.

Results: Depending on tumor site and jurisdiction, the largest differences between unadjusted (survival estimates taken from previous ICBP survival data) and adjusted (survival estimates recalculated taking into account differences in registration practice) for 1-year survival by cancer site were 1.3% for breast, 3.4% for colorectal, 7.3% for lung, and 2.6% for ovary. The survival gap bridged between jurisdictions with the highest (Sweden – breast and lung cancer, Victoria – colorectal cancer, Ontario – ovarian cancer) and lowest (Wales, breast, colorectal, lung and ovarian cancer) 1-year survival was respectively, 8.7%, 30.5%, 0.0%, and 13.6%.

Conclusion: This in-depth study has quantified the potential effect of variations in cancer registration protocols on international 1-year survival comparisons.

2E4

GEOGRAPHIC VARIATION IN CERVICAL CANCER SURVIVAL BY AGE AND MORPHOLOGY (CONCORD-2)

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Background: The CONCORD-2 study revealed that age-standardized 5-year net survival from cervical cancer in North America was among the highest in the world. However, within each country, there was variation between jurisdictions, ranging between 60% and 73% in Canada and 54% and 79% in the U.S.

Age at diagnosis and morphology are strong predictors of cancer prognosis. Therefore, we aim to explore whether these within country differences are still reflected in survival by age and morphology.

Methods: We analyzed data for 207,546 adult women (15-99 years) diagnosed with an invasive cervical tumor between 2001 and 2009 with follow-up to December 31, 2009, provided by 51 population-based cancer registries in North America.

Age-specific (15-44, 45-54, 55-64, 65-74, and 75-99 years) and morphology-specific (squamous cell or adenocarcinoma) net survival was estimated with the non-parametric Pohar-Perme estimator for two calendar periods, 2001-2003 and 2004-2009. To control for international differences in background mortality among women, we used life tables by single year of age, single calendar year, and in the U.S. by race.

Results: We will use maps to highlight the variation in 5-year net survival by age group and morphology in the 51 participating jurisdictions in North America. Generally, in both countries, survival differences were greatest for the eldest age group. There was large variation in survival for adenocarcinomas and squamous tumors within the U.S. and to a lesser extent in Canada, where variation for adenocarcinomas in the latter calendar periods was small.

Conclusion: These results will provide an opportunity to examine the extent of provincial or state disparities in cervical cancer survival by age and morphology. They will contribute to the development of policies to reduce inequalities in survival, and to the evaluation of current screening programs.

F Student Presentations II

1:30pm - 3:00pm

2F1S**DEVELOPING A RESTFUL HTTP SERVICE AS A FRONTEND FOR THE CDC TNM STAGING API****R Chui¹**, I Hands¹¹Kentucky Cancer Registry, Lexington, KY, United States

Background: In 2016, the CDC published a software application program interface (API) to perform calculations and provide useful information related to the TNM staging system. The CDC built the API on the .NET framework, facilitating integration on Windows-based environments. Central registries that rely on other environments, including the Kentucky Cancer Registry (KCR), needed an alternate method to integrate the TNM API into their operations.

Purpose: The Kentucky Cancer Registry creates and maintains hospital registry software running on a Java/Linux environment, which cannot interface with the TNM API. Moreover, the KCR registry software is a multi-user web application with concurrency requirements not addressed in the API design. We set out to create an interface that would allow multiple, concurrent users from a variety of environments to access the TNM API.

Methods: Using the C# language, we created a web service that would run on the .NET framework and interface with the TNM API. We were able to run the service on our Linux servers using an open-source implementation of the .NET framework called Mono. In designing the service, we used a principle called Representational State Transfer over the HyperText Transfer Protocol, a combination often called RESTful HTTP. The service marshals data using a well-known text syntax called JavaScript Object Notation (JSON). The use of these common web standards allows most programs capable of web communication, including our cancer registry software, access to the API.

Conclusions: We show that a RESTful HTTP interface to the TNM API offers advantages such as full integration of a .NET library into Java-based cancer registry software and concurrent access in a multi-user environment. This integration has improved our registry software and facilitated collection of high quality cancer data by providing detailed feedback to abstractors. The source code for this service is freely available to the NAACCR community.

2F2S**ACCURACY OF THE HPV STATUS SITE SPECIFIC FACTOR 10 (SSF-10) VARIABLE FOR HEAD AND NECK CANCER (HNC) CASES IN IOWA: 2010-2014****A Kahl¹**, M Charlton¹, N Pagedar², B Matt¹, C Platz¹, C Lynch¹¹University of Iowa College of Public Health and Iowa Cancer Registry, Iowa City, IA, United States; ²University of Iowa Carver College of Medicine, Department of Otolaryngology-Head and Neck Surgery, University of Iowa, Iowa City, IA, United States

Background: Testing of HPV surrogate marker p16 is an established method of assessing HPV status among HNC patients, but is not specifically addressed in 'SSF-10: HPV Status' code instructions. Furthermore, AJCC recommended p16 testing not be considered HPV testing. This could lead to coding inconsistencies.

Purpose: To assess accuracy of SSF-10, types of HPV testing performed in Iowa, and impact of excluding p16 from HPV testing, and to determine patient and facility characteristics associated with HPV testing.

Methods: SSF-10 codes, SEER*DMS abstracts, and pathology reports were reviewed for HNC cases diagnosed in Iowa from 2010-2014. SSF-10 values were recoded using two sets of alternative guidelines: (1) AJCC-recommended guidelines classifying p16 testing only as 'unknown HPV status,' and (2) our revised coding guidelines classifying p16 positive cases as 'HPV + -type NOS.' Analyses of characteristics associated with HPV testing were conducted using Chi-square tests and logistic regression.

Results: 1,062 cases were reviewed; 39% were initially coded as having HPV testing. Based on guidelines including p16, 47% had HPV testing. The majority had p16 testing only (56%), followed by p16 + HPV-DNA testing (22%), and HPV-DNA testing only (20%). Based on AJCC guidelines excluding p16, 21% had HPV testing. Before review, 52% of those tested for p16 only were coded as 'HPV + -type 16.' After review, 94% of these were recoded as 'HPV + -type NOS' because p16 does not test for a particular type of HPV. Those diagnosed in later years, oropharyngeal vs. other HNC sites, receiving surgery, and treatment at a large hospital had higher odds of HPV testing.

Conclusions: Findings suggest p16 is the main form of HPV testing in Iowa but is not consistently being coded as HPV testing. Also, many p16 positive cases were being incorrectly coded as 'HPV-type 16.' New codes or revised instructions should be implemented to improve the consistency and accuracy of this variable.

2F3S

CANCER INCIDENCE AND TRENDS IN RURAL AND URBAN POPULATIONS IN THE UNITED STATES

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Background: Rural populations are more likely to live in poverty and smoke and are less likely to engage in cancer screening, putting them at greater risk for cancer. Recent studies suggest rural individuals are more likely to die of cancer than their urban peers, but there is limited reporting of national level, rural-urban differences in incidence and trends.

Purpose: To describe rural-urban differences in cancer incidence and trends in the U.S.

Methods: We analyzed data from the North American Association of Central Cancer Registries' Cancer in North America public use data set, which includes data from 46 states. We calculated age-adjusted incidence rates, rate ratios, and annual percentage change (APC) for the top 10 cancers and for tobacco-associated and human papillomavirus (HPV) associated cancers. Rural-urban incidence rate comparisons were made by sex, race/ethnicity, U.S. census division, and county-level poverty rate for 2009 to 2013. Trends were analyzed for 1995 to 2013.

Results: Combined cancers incidence rates were higher in urban populations (448.7 urban vs. 446.4/100,000 rural; $p < 0.05$) across sexes and races/ethnicities, consistently so across the U.S., except the South. The decrease in cancer incidence rates were greater in urban vs. rural populations. Rates for cancers associated with tobacco and HPV, colorectal, and lung and bronchus cancer were higher in rural populations, as was cervical cancer among both white and black rural females. Other rural disparities included increased colorectal cancer rates regardless of poverty level and increasing HPV-associated cancer incidence ($APC = 0.724$, $p < 0.05$) vs. stable rates in urban populations.

Conclusion: Cancer rates associated with tobacco and HPV and cancers that can be prevented with screening are higher in rural populations. Opportunities exist to address these disparities with locally, culturally targeted public health and provider-based interventions to improve screening rates and reduce cancer risk

2F4S

CERVICAL CANCER SURVIVAL AMONG YOUNG CALIFORNIA WOMEN

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Background: Cancer researchers have hypothesized that young women present with more aggressive forms of cervical cancer and thus may have poorer outcomes than older patients. However, previous studies examining the effect of young age on cervical cancer survival have produced inconsistent results. It is important to understand the role of age as a prognostic factor in order to plan the most appropriate course of treatment.

Purpose: To assess the effect of young age on cervical cancer survival.

Methods: Women aged 18 and older diagnosed with invasive cervical cancer between 2004 and 2014 were identified through the California Cancer Registry. Cox proportional hazard regression was used to estimate cervical cancer survival while adjusting for age at diagnosis, race, socioeconomic status, stage at diagnosis, tumor grade, and histology. Survival was also compared across age groups within these same demographic and clinical subgroups.

Results: We identified 14,704 cervical cancer patients for analysis. The distribution of age group at diagnosis was 2,202 (14.98%) 18-34 years, 5,789 (39.37%) 35-49 years, 4,240 (28.84%) 50-64 years, and 2,473 (16.82%) 65+ years. The youngest group had better survival than the oldest patients ($HR = 0.76$, 95% $CI = 0.64, 0.91$). Patients 18-34 years old did not have significantly better or worse survival than those 35-49 years old for any racial, socioeconomic, stage, grade, or histologic subgroup. Among white women, patients 18-34 years old had better prognosis than women aged 50-64 ($HR = 0.73$, 95% $CI = 0.50, 0.95$) and women aged 65+ ($HR = 0.52$, 95% $CI = 0.39, 0.69$). Young patients had better survival than the two oldest groups for all other racial, socioeconomic, stage, grade, and histologic subgroups, though the differences were not all significant.

Conclusions: These results indicate that young women with invasive cervical cancer do not have poorer prognosis than older women. Younger patients may not need to be treated more aggressively.

A Cancer Reporting Strategies and Implications

11:00am - 12:45pm

3A1

MINING THE DIAGNOSTIC INDEX TO IMPROVE CANCER INCIDENCE REPORTING

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Background: The Detroit SEER registry mines each reporting facility's diagnostic index to find missed cases. The diagnostic index lists diagnoses coded to a patient during any encounter for a specified year at the facility. Codes listed in the "Reportable Neoplasms" section of ICD-9-CM are requested. Each electronic diagnostic index is first loaded to the Detroit SEER database and linked to previously identified cancers, to minimize the number of entries requiring manual review.

Purpose: The purpose of this analysis is to quantify the number of missed cases found as a result of mining facilities' diagnostic indices.

Methods: Incident cancers (N=126,234) diagnosed 2009-2013 were evaluated by record type to determine which cancers were identified from a diagnostic index. Reportable cases without either a case finding record or an HL7 E-path record but with an abstract and a diagnostic index record were considered to have been identified from a diagnostic index. Chi-square analyses were performed to evaluate differences between cases identified routinely (N=120,889, 95.77%) vs. from diagnostic index (N=5,345, 4.23%).

Results: Detroit SEER identified, on average, 4% of new cancers each year from diagnostic indices. Most often captured by diagnostic index review were: reportable benign (27.48%) and borderline (9.97%) tumors, tumors of the Eye (20.48%), Hematopoietic System (10.85%), Other Endocrine (21.69%), and Other Nervous System (27.17%). Identification from diagnostic index was more frequent for females 4.52% (males 3.93%, $p < .05$), other race 4.62% (white 4.46%, black 3.52%, unknown race 2.6%, $p < .05$), ages 65+ 4.65% (age < 65 3.8%, $p < .05$), cases not microscopically confirmed 18.75% (microscopically confirmed 3.28%, $p < .05$), and stage not applicable 26.12% (i.e. benign/borderline brain/ns, $p < .05$).

Conclusion: Although labor intensive, manually mining each facility's diagnostic index to capture missed cancers is important to accurate incidence reporting.

3A2

EMERGENCY DIAGNOSIS OF CANCER AND PREVIOUS PRIMARY CARE CONSULTATIONS: INSIGHTS FROM LINKED CANCER PATIENT SURVEY AND ADMINISTRATIVE DATASETS

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Background: Emergency diagnosis of cancer is common and etiologically complex, and has previously been considered to represent failures of primary care; however, the proportion of emergency presenters who have consulted previously with relevant symptoms is uncertain. This study aimed to examine how many cancer patients who were diagnosed as emergencies have had previous primary care consultations with relevant symptoms; and among those, to examine how many had multiple consultations.

Methods: Data from the National Cancer Patient Experience Survey were linked to population-based cancer registration data and the diagnostic route information (Route to Diagnosis) was extracted, for a cohort of patients diagnosed in 2010. For emergency presenters with 18 different cancers, we examined associations for two outcomes (prior general practitioner consultation status, and 'three or more (3+) consultations among prior consultees) using logistic regression.

Results: Among 4,647 emergency presenters, 1,349 (29%) reported no prior consultations, being more common in men (32% vs. 25% in women $p < 0.0001$), older (44% in '85+' vs. 30% in 65-74 year olds, $p < 0.0001$), and most deprived (35% vs. 25% least deprived, $p = 0.0014$) patients; and highest/lowest for patients with brain cancer (46%) and mesothelioma (13%), respectively ($p < 0.0001$ for overall variation by cancer site).

Among 3,298 emergency presenters with prior consultations, 1,356 (41%) had 3+ consultations, being more likely in women ($p < 0.0001$), younger ($p < 0.0001$), and non-white patients ($p = 0.017$) and those with multiple myeloma, and least likely for patients with leukemia ($p < 0.0001$).

Conclusion: Against suggestions that emergency presentations represent missed diagnoses, about one-third of emergency presenters (particularly older and poorer patients) have no prior general practitioner consultations. Furthermore, only about a third report multiple (3+) consultations, which are more likely in harder-to-suspect groups.

3A3

COMPARABILITY OF EARLY CASE CAPTURE PEDIATRIC AND YOUNG ADULT INCIDENCE RATES

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Background: The 2008 Caroline Pryce Walker Conquer Childhood Cancer Act required CDC to enhance and expand the infrastructure for tracking the epidemiology of pediatric cancer into a comprehensive nationwide registry of actual occurrences of pediatric and young adult cancer (PYAC). This registry is updated biannually to include the reporting of PYAC cases within 4 months of the close of each reporting period, known as Early Case Capture (ECC). To date, age-adjusted incidence rates using the data submitted to CDC by the participating states have not been evaluated.

Purpose: This evaluation seeks to determine the comparability of incidence rates (IR) calculated using the ECC dataset to the published rates for the U.S.

Methods: A SEER*Stat dataset was created for diagnosis years 2012-2016 and age-adjusted IRs were calculated for all sites and nine additional sites. Those rates were compared with the childhood rates published in USCS. Rates were also generated for the participating states combined using the USCS and ECC dataset to evaluate comparability.

Results: Using the USCS dataset, incidence rates for participating states combined were similar to those published in USCS regardless of race or sex, except for all sites among females, which was slightly higher. However, when stratified by site, the IRs were similar regardless of race or sex. Using the ECC data file, the 2015 incidence rates were similar to USCS, except for all sites for all races and white males. More variability was identified for the 2016 incidence rates with less variability among females.

Conclusion: PYAC IRs from the ECC-participating states are an adequate representation of PYAC incidence in the U.S. for the same time period as USCS. Incidence rates from early case capture are comparable at the 1-year point. At the 6-month point, IRs are less comparable and need to be used with caution.

3A4

EVALUATING USEFULNESS OF CASE COMPLETENESS ESTIMATES AS A CRITERION FOR INCLUSION IN USCS

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Background: CDC leads the effort to produce and publish the web-based report of the official federal statistics on cancer incidence from registries that have high-quality data and cancer mortality statistics for each year and the most recent 5-year period combined—United States Cancer Statistics (USCS). High-quality cancer incidence data has been demonstrated by meeting established criteria for all cancer sites combined related to completeness of case ascertainment and missing or unknown values.

Purpose: This analysis evaluated the comparability of age-adjusted incidence rates (IR) when completeness of case ascertainment was excluded as a criterion.

Methods: Incidence rates for all states combined were calculated using data submitted to CDC and NCI in November 2015 and evaluated for comparability with published USCS data.

Results: For the 2013 diagnosis year, males and females, all races, for nine cancer sites showed minimal difference when including all states. One site had an absolute difference of six tenths (439.0 vs. 438.4) and the remaining differed by one tenth. The confidence intervals for these cancer sites overlapped or were contiguous. When stratifying by male and female, additional cancer sites showed differences though the absolute difference was similar to males and females combined, except for all sites among males with an absolute difference of 1. Absolute differences for the 2009-2013 combined diagnosis years were similar to the 2013 results. However, there were fewer cancer sites with differences and the highest absolute difference was four tenths (456.7 vs 456.3).

Conclusion: The estimated completeness of case ascertainment is an appropriate measure for evaluating a cancer registry's activities to assure all cancer cases are received, and most registries are meeting this established standard. Inclusion of data from a registry that does not meet the standard does not significantly impact IRs produced for USCS.

A Cancer Reporting Strategies and Implications

11:00am - 12:45pm

3A5

EXAMINATION OF PRELIMINARY CANCER SURVEILLANCE DATA FROM THE NATIONAL PROGRAM OF CANCER REGISTRIES, DIAGNOSIS YEAR 2012

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Background: The United States Cancer Statistics (USCS) are the official federal cancer statistics and contain the most complete and accurate data. Yet, the data are typically over 24-months old by the time they are published. The National Program of Cancer Registries (NPCR) contributes 96% of the data in USCS and has been collecting preliminary data since 2000, although the quality of these data has not been published. The objective of this analysis is to determine how accurately preliminary cancer data submitted by NPCR grantees compare to cancer rates published in USCS.

Methods: Cancer data were obtained for diagnosis year 2012 among all cancer sites combined and subset of 20 major cancer sites that are used to test completeness of case ascertainment. Age-adjusted incidence rates (IR), rate ratios (RR), and 95% confidence intervals were calculated for data submitted in November 2013 (12-month data or NPCR preliminary) and compared to published USCS data, which used data submitted in November 2014 (24-month data).

Results: For all cancer sites, all races combined, the rates for the NPCR preliminary data were slightly lower than the published USCS rate (401.3 vs 440.3), but showed comparability (RR=0.91). Regardless of race, the majority (15/20) of cancer sites had rate ratios of at least 0.90. For hospitals or clinics, the site-specific RRs were high, but were more variable for other non-hospital centers and were lower for cases obtained from death certificates and autopsies.

Discussion: This is the first known study examining cancer incidence rates calculated using earlier cancer surveillance data than is traditionally used. The strengths of this analysis include the representativeness of the sample, and comparability with the USCS data. Our results also show that compared to other sources, early reporting from hospitals most accurately estimate cancer rates in USCS.

3B1

AN INTEGRATED U.S. NATIONAL MORTALITY DATABASE BY NATIVITY: PROMISES AND ISSUES

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Background: The heterogeneity of immigrants affects their vulnerabilities to inadequate health care and undesirable health outcomes. Despite the needs to identifying and targeting the most needed, there is not a national database tool to quantify the impacts of immigration status on cancer mortality in the U.S.

Purpose: To develop denominator estimates by nativity and create an integrated SEER*Stat mortality incidence database for users to use to monitor trends and patterns in cancer mortality rates by nativity.

Methods: This study applied sampling estimation theories and estimated at risk population totals and sampling errors from the Census 2000 long-form survey and 2006-2014 annual American Community Surveys. These estimates are stratified by 19 age group, gender, race, and ethnic origin, state, and nativity status. An annual mortality incidence SEER*Stat database from 2000 to 2014 was then created by linking these denominator estimates with the death count database drawn from the National Vital Statistics System. The impact of sampling errors on the precision of mortality rates are evaluated using simulation studies.

Results: The denominator estimates are less stable for older age groups. When estimated assuming no errors in the denominators, the variances of rates are underestimated, which leads to below-nominal coverage confidence intervals. The amount of under-coverage bias increases with the size of errors in the denominator for crude rates. Despite that, when restricting to analyses with the denominator errors less than 10% of the point estimates, the coverage is reasonably close to the nominal. This database coupled with the SEER*Stat computational tool allows a wide range of analytic explorations of cancer mortality disparities. Further research is needed to explicitly incorporate the errors in estimating the variance of a rate.

3B2

COMPARISON OF COMORBIDITY INDICES DERIVED FROM CLAIMS DATA

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Background: Comorbidity burden is an important concept used in outcomes research that is not well captured in cancer registry data. While several comorbidity indices developed from administrative claims data have been widely used in cancer research, it is not clear which index is best suited for population-based cancer research utilizing cancer registry data. The Kentucky Cancer Registry (KCR), in collaboration with the Centers for Disease Control and Prevention, conducted a study to link registry data with Medicare, Medicaid, and private insurance claims files. Using the linked data, KCR calculated several comorbidity indices and examined their characteristics.

Methods: Four comorbidity indices (Modified Charlson, Klabunde Site Specific, ACE-27, and Elixhauser) for three cancer sites (breast, lung and colorectal) were calculated from the claims data for cancer cases diagnosed in Kentucky from 2007-2011. The analysis included only first primary cancer cases with at least 1 year continuous insurance enrollment prior to cancer diagnosis. Logistic regression was used to ascertain the predictive power of each index with 1-year or 2-year survival as the outcome variable. The c-statistic and Akaike Information criterion (AIC) were compared and a bootstrap approach was used to calculate 95% confidence intervals for several statistics.

Results: Across the three cancer sites, the Modified Charlson Index and the Klabunde Site Specific Index performed the best while the ACE-27 was the worst in terms of AIC and c-statistic. For example, for breast cancer, compared to the base model, the magnitude of increase in c-statistic values with the addition of the comorbidity index into the model was 0.0076 for ACE-27, 0.0083 for Elixhauser, 0.0120 for Klabunde, and 0.0134 for Modified Charlson; and the reduction of the AIC values was 29.81 for ACE-27, 44.10 for Elixhauser, 73.31 for Klabunde, and 66.34 for Modified Charlson.

Conclusion: Our results indicated that use of the modified Charlson index or the Klabunde Site Specific Index as the measure of comorbidity is most appropriate when utilizing cancer registry data linked with medical claims files for outcomes research.

B Tools and Analysis

11:00am - 12:45pm

3B3

VALIDATION OF AN ALTERNATIVE APPROACH TO ASCERTAINING VITAL STATUS INFORMATION ON THE CANADIAN CANCER REGISTRY**L Ellison¹**, C Pelletier¹, S Bryan¹¹Statistics Canada, Ottawa, ON, Canada

Background: The Canadian Cancer Registry (CCR) has traditionally been death cleared through a process that links CCR data to the Canadian Vital Statistics Death Database (CVSD)—absent data from the province of Quebec for both databases. In January 2017, “linkage keys” were made available through Statistics Canada’s recently created Social Data Linkage Environment (SDLE) that allowed for the exploration of an alternative approach. The SDLE is a highly secure environment that facilitates the creation of linked population data files for analysis. The new approach incorporates additional sources of data that may improve the precision of vital status information that is available for analysis.

Purpose: To validate the newly linked file for fit for use in analytical studies. If fit, to provide context for researchers subsequently using the new file and their target audiences.

Methods: The CCR was linked to the CVSD and the T1 Personal Master file (tax) in the SDLE. Linkage keys were used to merge vital status information back to the same version of the CCR that was previously death cleared in 2011. Initially, Quebec data were excluded in order to mimic the original process. Variables identifying the source(s) of links to deaths were created for both the original and the new files.

Results: The results of the two approaches will be compared on an individual and aggregate basis (counts). Where a death is indicated, both the death record identified as a link, and the source(s) of the link will be compared. The impact on net survival results will also be explored. Comparisons of results will be made by a number of variables including sex, age group, geography, time period, and type of cancer identified at diagnosis.

Implications: Successful validation of the new approach will permit the calculation of updated survival and prevalence figures through an improved approach. It is also the first step in making this type of data accessible for other research purposes.

3B4

HYSTERECTOMY-CORRECTED RATES OF ENDOMETRIAL CANCER AMONG WOMEN OF REPRODUCTIVE AGE IN THE UNITED STATES, SEER 1992-2010**S Temkin¹**, E Kohn², L Penberthy², K Cronin², L Dickie², L Minasian², **AM Noone²**¹Virginia Commonwealth University, Richmond, VA, United States; ²National Cancer Institute, Bethesda, MD, United States

Background: The reporting of endometrial cancer incidence rates does not typically account for hysterectomy, which eliminates subsequent risk of this disease. Hysterectomy is common and rates vary by age and race. Furthermore, rates have changed over time which can distort incidence trends. This analysis describes the impact of hysterectomy on recent incidence rates and trends of Type 1 endometrial cancer in the United States among women of reproductive age.

Methods: In order to obtain more accurate estimates of endometrial cancer, women who were no longer at risk of endometrial cancer were removed from the population. Hysterectomy prevalence for states in the SEER registry was estimated using data from the Behavioral Risk Factor Surveillance System. The population was adjusted for each age, race, and calendar year strata. Age-adjusted incidence rates and trends of Type 1 endometrial cancer among women age 20 to 49 corrected for hysterectomy were estimated using data from SEER registries, covering 13% of the U.S. population.

Results: Hysterectomy prevalence varied by race and age over the study period. It was less than 1% among women age 20-29 of any race. However, among women age 40-49, the prevalence was 50% among non-Hispanic (NH) black women compared to 28% among NH white women. The impact of hysterectomy correction on the age-adjusted incidence rates changed over time and was greater for black women. In general, the corrected trends showed a slower increase compared to the uncorrected.

Conclusion: Endometrial cancer incidence rates in the U.S. were stable among women of reproductive age. Declining hysterectomy rates and differences in hysterectomy rates by race distort trends as routinely reported. Correcting for hysterectomy is crucial to understand the incidence and trends over time for all age groups.

3C1

TWELVE-YEAR STUDY UPDATE FOR A POSTMARKETING CASE SERIES STUDY OF ADULT OSTEOSARCOMA AND TERIPARATIDE IN THE U.S.

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Background: The Osteosarcoma Surveillance Study, a 15-year safety surveillance study, was initiated in 2003 to monitor for a possible association between teriparatide (an osteoporosis treatment) and osteosarcoma, which occurs in the U.S. in adults aged 40 years or older at a background incidence rate of approximately 2.5 cases per million per year. Multiple state, SEER regional, and comprehensive cancer registries are actively participating in this study.

Objective: To provide an update for this ongoing study, including descriptive characteristics of osteosarcoma patients aged 40 years or older, and participation by cancer registries.

Methods: Incident cases of osteosarcoma diagnosed between January 1, 2003, and December 31, 2014, and tumor information are identified through cancer registries. After consent, information including demographics, prior medications, and exposure to possible risk factors is ascertained via telephone interview. Requirements necessary for contacting the patient (patient-access pathways) vary among participating cancer registries, from passive notification to active permission from the patient and/or physician.

Results: As of September 30, 2016, 3,128 incident cases of osteosarcoma in patients aged 40 years or older were identified by 29 cancer registries. After completing individual cancer registry requirements to release contact information, 2,166 were available to be interviewed. Of these, interviews were completed for 1,031 patients (48%). Of those interviewed, two patients reported use of teriparatide prior to diagnosis of osteosarcoma, which is within the expected range assuming no increased risk with treatment.

Conclusions: Data from this ongoing study continue to contribute to knowledge about the long-term safety of teriparatide. Participation by many cancer registries is essential for drug safety surveillance for rare cancers.

3C2

MAKING AN IMPACT: OPTIMIZING PATIENT RECRUITMENT IN HARD TO REACH POPULATIONS WITH NJSCR

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Background: The IMPACT (Improving Patient Access to Quality Cancer Treatment) study is a pilot project examining barriers in access to care, treatment, and outcomes among cancer patients in New Jersey. Compared to respondents for breast, colorectal, and prostate surveys, we observed significantly lower response rates for cervical cancer surveys during the initial recruitment period. The review discusses changes to key components of recruitment materials for cervical cancer surveys to improve response rates.

Methods: Eligible participants were identified from the New Jersey State Cancer Registry, including female breast, prostate, colorectal, or cervical cancers diagnosed from 2012 to 2014. Site-specific English surveys administered via mail between September 2015 and August 2016 with a \$15 incentive post-completion. We evaluated recruitment rates by age, race, and ethnicity to identify strategies to improve response rates in the cervical cancer population. Revised cervical cancer survey efforts included: offering a Spanish-version survey, reducing the length of the survey by half, providing the option to participate via telephone, and increasing incentives to \$25. Passive refusers, those never contacted, and those ineligible due to Spanish language preference were recontacted.

Results: Initial cervical cancer recruitment rate was 11.5%. Of eligible Medicaid and uninsured women (56% of non-responders), 47% were Hispanic. After making adjustments to the recruitment protocol, response rates increased to 23%. However, uptake of Spanish-version and telephone-based surveys remained low.

Conclusions: While the total surveys returned did not meet the initial recruitment goal, it is important to note that offering materials in Spanish and offering larger incentives while also significantly shortening a paper survey had a dramatic effect on response rates. This is particularly relevant for future studies recruiting NJSCR participants in hard to reach populations.

3C3

AN ECOLOGICAL STUDY OF CANCER AND FLUORIDE IN DRINKING WATER

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Background: Dental caries are a significant public health problem, and sizeable inequalities exist between affluent and deprived communities. Water fluoridation schemes have been introduced to community water supplies in an effort to reduce levels of decay in the population. Public Health England (PHE) is required by legislation to monitor the effects of water fluoridation schemes on the health of people living in areas covered by these arrangements. This includes the incidence of certain cancers.

Methods: Ecological level exposure to fluoridated water was estimated at LSOA level; small areas used for statistical analysis with an average population of 1,500 people. Exposure was based on data from the Drinking Water Inspectorate records of fluoridation. Data on incidence of primary invasive bladder cancer (ICD10 C67) in 2000-2010, primary osteosarcoma (ICD10 codes 9180 to 9195, suffix 3) in 1995-2010, and all primary cancers (C00-C97 excl. C44) in 2007-2010, was extracted by PHE's National Cancer Registration and Analysis Service. Multivariable analysis was carried out to account for differences in age, gender, deprivation, and ethnicity.

Results: Following adjustment for confounding, there was strong evidence that the incidence rate of bladder cancer was lower in fluoridated areas (8.0% lower; 95% CI -9.9% to -6.0%; $p < 0.001$). There was no evidence for a difference in osteosarcoma rates for those living in fluoridated compared to non-fluoridated areas. The same held true for incidence of all primary cancers.

Conclusion: Use of an ecological level measurement of fluoridation, in essence reflecting the nature of the intervention, does not take into account individual consumption of fluoride. Nonetheless, there is no evidence raised by this study which supports any increased risk of cancer due to water fluoridation schemes. The report by PHE will be repeated in 2018 with more detailed data on fluoride exposure.

3C4

CANCERS ATTRIBUTABLE TO EXCESS BODY WEIGHT IN CANADA IN 2010

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Background: Excess body weight (BMI ≥ 25.00 kg/m²) is an established risk factor for diabetes, hypertension, and cardiovascular disease, but its relationship to cancer is underappreciated. This study used population attributable fractions (PAFs) to estimate the cancer burden attributable to excess body weight in Canadian adults (age 25+ years) in 2010.

Methods: PAFs were estimated using relative risk (RR) estimates from the World Cancer Research Fund International Continuous Update Project, BMI-based estimates of overweight (25.00 to 29.99 kg/m²) and obesity (30.00+ kg/m²) from the 2000-2001 Canadian Community Health Survey, and cancer case counts from the Canadian Cancer Registry. PAFs were based on BMI corrected for the bias in self-reported height and weight.

Results: In Canada in 2010, an estimated 9,645 cancers were associated with excess body weight, representing 5.7% of all cancers (males 4.9%, females 6.5%) and 14.9% of cancers associated with high BMI (males 17.5%, females 13.3%). Cancers with the highest PAFs were esophageal adenocarcinoma (42.2%), kidney (25.4%), gastric cardia (20.7%), liver (20.5%), colon (20.5%), and gallbladder (20.2%) for males and esophageal adenocarcinoma (36.1%), uterus (35.2%), gallbladder (23.7%), and kidney (23.0%) for females. Cancers with the greatest number of attributable cases were colon (1,445), kidney (780), and advanced prostate (515) for males and uterus (1,825), post-menopausal breast (1,765), and colon (675) for females. Irrespective of sex or cancer, PAFs were highest in the prairies and Atlantic region and lowest in British Columbia and Quebec.

3C5

SCREENING RECOMMENDATION AND BREAST CANCER INCIDENCE IN SOUTH CAROLINA: A BRFSS AND CANCER REGISTRY ANALYSIS

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The United States Preventive Services Task Force recommends all women ages 50-74 receive a mammogram every 2 years. However, the literature shows there are racial disparities in female breast cancer (BC) screening, incidence, and mortality. We investigated these disparities in South Carolina (SC). Screening data were obtained from the SC Behavioral Risk Factor Surveillance System (BRFSS) for 2013 (n = 3,107). BC data were obtained from the SC Central Cancer Registry for 2011-2013 (n = 8,773). Incidence and mortality rates, proportions, and 95% confidence intervals (CIs) were calculated for mammography screening, insurance coverage, stage, and hormone receptor status.

Significantly more black women (84.4%; CI: 80.9%-87.9%) met the mammogram recommendation than white women (76.0%; CI: 73.4%-78.7%). Among those who met the screening recommendation, and among those women diagnosed with BC, more blacks had health insurance than whites. White women had a significantly higher incidence rate than black women (330.1 and 310.3 cases per 100,000 women, respectively [p-value: 0.03]). Blacks had a significantly lower proportion of early stage diagnosis (65.6%) than whites (73.6%). Black women had higher proportions of the more aggressive triple negative (TN) and HER2 positive breast cancers than white women (15.0% vs. 6.6% and 14.0% vs. 11.5%, respectively). TN is more commonly found at late stage diagnosis, and more frequently among blacks than whites. More black women (20%) were diagnosed with late stage TN breast cancer than white women (9.3%). Further, black women had a significantly higher mortality rate than white women (70.1 and 46.1 deaths per 100,000 women, respectively [p-value: <0.001]).

Although the analysis has some limitations, these findings generally agree with the literature. Further research is needed to assess the inverse relationship between screening and insurance coverage with later stage cancer for black women and higher incidence rates for white women.

D Data Transmission Standards and “Fake Data”

11:00am - 12:45pm

3D1

RESULTS OF A PILOT PROJECT IMPLEMENTING THE NAACCR XML TRANSMISSION STANDARD

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Background: The XML Data Exchange WG (WG) began soliciting participants in November 2016 to join a pilot project implementing the XML Data Exchange Standard between hospital software vendors and central registries. Interested parties joined the WG meetings for mentoring and discussion of technical issues about their data transmission projects. Results of the pilot projects will be presented during this session.

Purpose: The pilot project will help inform the planning, adoption, and enhancement of the NAACCR XML data exchange standard for the entire NAACCR community.

Results and Discussion: Pilot participants will present the results of their projects and then join a round table discussion. Presentations will include:

- Outline of the project milestones and success metrics
- Amount of effort required to develop and test the XML standard
- Results and methods for validating XML data
- Development of custom XML elements including state/requestor items and extensions of the XML standard
- Description of transmission method
- Challenges and workarounds regarding the application of edits
- Lessons learned and recommendations

3D2

BREAKING THE BARRIER OF THE NAACCR DATA TRANSMISSION LAYOUT WITH COLLEGE OF AMERICAN PATHOLOGISTS (CAP) BIOMARKER TEMPLATES

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Background: In 2018, cancer registries will be adding biomarkers and prognostic factors (BMPF) required and recommended for staging in the 8th Edition of AJCC's *Cancer Staging Manual*. NAACCR committees and task forces, the College of American Pathologists (CAP), and registry standard setters have been working to implement the expanded dataset and have been considering new data structures to augment or supplant the current NAACCR “flat” transmission file. CDC and CAP have collaborated on a pilot project to build on the existing technology used for CAP's electronic Cancer Checklists (eCCs) to allow submission of BMPF data entered by cancer registrars.

Purpose: 1. To pilot test a novel, web-based, easy-to-use method for collecting standardized data on biomarkers and prognostic factors using technology that is interoperable, flexible, easy to maintain, and based on current informatics best practices.
2. To validate this method as a potential technology solution for other parts of the NAACCR record.

Methods: We incorporated CAP's breast biomarker template into CDC's Web Plus abstracting tool. The CAP template was provided as an XML document in Structured Data Capture (SDC) format, which is also used for the new eCCs. Forms completed by the abstractor are associated with a corresponding full NAACCR abstract and transmitted as an XML file to one or more pre-designated locations. The BMPF data are mapped to values and locations compatible with NAACCR's current flat file, and the XML is stored as text files associated with the registry's patient and tumor records.

Results: We will present detailed information on the SDC model and describe how SDC and XML are used. Internet access permitting, we will then demonstrate completion of the breast biomarkers form integrated into Web Plus and secure transmission of the SDC form and NAACCR abstract to a designated registry location. Results from the field test will be reviewed. Plans for expanding the pilot test will be discussed.

3D3

FAKING IT: BUILDING A SIMULACRUM OF NON-IDENTIFIABLE MODELLED CANCER DATA TO SUPPORT RESEARCH

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Background: The National Cancer Registry contains data about 15 million cancer patients, recording over 200,000 diagnosed tumors each year. The data is confidential and access is stringently controlled by the Office for Data Release. The Simulacrum project aims to create a simulated dataset which matches the real datasets as closely as possible, to make cancer data more widely accessible.

Method: We tested key feature variables in cancer data for 2014 statistically for independence, and inferred associations otherwise. Guided by these linkages, we sampled from distributions given by real cancer data to produce tumor-level data. This presentation discusses: the tools developed to test the data for realism, methods used to ensure preservation of research-relevant statistical features, and steps taken to limit disclosivity risk.

Results: The datasets produced replicate the shape and quality constraints of real cancer data. In testing, low-dimensional statistics correspond closely to those for real-world data—incidence and age profiles by cancer site and stage distribution. Modelling preserves key multidimensional characteristics of the data, such as the influence of age on stage, which are automatically identified from strong correlations in the original cancer registry data set. This correspondence in shape and distributions means that queries run on the test data may expect similar results to queries run on the simulated data, and are also compatible with the real data without significant modifications.

Conclusion: The creation of a non-identifying modelled dataset removes a huge obstacle for research on cancer data. It should support estimates of data quality and size of cohorts, or exploration before detailed investigation. This dataset is a valuable resource for academic and commercial researchers to build their case for further data access and provides a proof of concept for modelling of other cancer datasets.

E Improving Cancer Treatment Data

11:00am - 12:45pm

3E1

COMPLETE CENTRAL REGISTRY TREATMENT INFORMATION REQUIRES ONGOING REPORTING AND CONSOLIDATION

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Background: Central cancer registries are challenged to capture complete population-based treatment information. SEER standards require at least 95% complete case reporting for 12-month data submissions. Additionally, Commission on Cancer (CoC) hospitals must transmit cases to state registries within 6 months of diagnosis. However, if treatment or treatment reporting is delayed beyond this timeframe, registries may be at risk of failing to capture complete treatment.

Purpose: We conducted a study to evaluate delays in cancer treatment administration, capture, and reporting to the Kentucky Cancer Registry (KCR) over time. Our specific aims were to quantify changes in treatment data from the time cases were first reported, through at least 15 months' post diagnosis and to evaluate whether central registry best practices should include the consolidation of additional treatment information following first reports.

Methods: We examined treatment information for invasive adult cancer cases diagnosed in 2014 and reported to the KCR through our Cancer Patient Data Management System. Archived central registry databases were used to assess treatment delays and treatment reporting delays. Data were analyzed for CoC and non-CoC facilities for lung, breast, prostate, colon and rectum, and for all sites combined.

Results: Our study revealed different patterns for delays in both treatment and treatment reporting by site and treatment modality. For example, breast cancer cases were treated between 4 and 10 months following diagnosis, but some treatments extended out through 18 months for some patients. Likewise, 95% of treatment was reported to KCR between 11 and 23 months, but some treatment reports continued through 26 months, the maximum interval examined by the study.

Conclusions: Our results demonstrate that in order to capture 95% complete treatment, central registries should continue to obtain and update treatment information through at least 21 months beyond the date of diagnosis.

3E2

BETTER LATE THAN NEVER? UTAH CANCER REGISTRY'S EVALUATION OF 15-MONTH RE-SUBMISSION OF ABSTRACTS FOR COMPLETE TREATMENT DATA

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Background: Hospitals are encouraged to submit cases to the central registries in a timely manner for annual SEER submission. There is concern SEER registries miss complete treatment when cases are submitted before completion of first course therapy.

Purpose: The objectives of this study were to compare the costs and benefits of 15-month re-submitted abstracts from Commission on Cancer (CoC) accredited hospitals in terms of central registry CTR coding time and data quality improvement. Our intent was to see if the differences in treatment and staging data between hospital cases submitted at 12 and 15 months warranted the added effort. An additional objective was to assess the tradeoff between timeliness and completeness of submitted abstracts.

Methods: A study was undertaken to have Utah CoC hospitals re-submit NAACR abstracts for all 2014 cases 15 months from the end of the diagnosis year. The Utah Cancer Registry consolidated the new abstracts, compiled the data electronically, and manually reviewed differences between initial submission and re-submission for breast, lung, prostate, colon and rectum cases.

Results: A total of 2016 cases were eligible for the study and 598 with differences were manually reviewed. A total of 253 cases (12.5%) resulted in updated treatment and/or staging information. Five cases were identified that had not previously been reported. Breast cancer cases had the highest proportion of updates to treatment (7%), and the changes were evenly distributed between radiation, surgery, hormone and chemotherapy treatments.

Conclusion: A substantial proportion of cases had new treatment and staging information received from the 15-month updated abstracts. Re-submitting files at 15 months does appear to be a good practice in order to have more complete data for UCR's annual SEER submission.

3E3

USING POPULATION-BASED CANCER REGISTRY DATA TO EXTEND CLINICAL TRIAL FINDINGS: SAVING MORE LIVES

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Background: The bowel can be distinguished as right (cecum-transverse colon) and left (splenic flexure-rectum), consistent with embryologic origin. Clinical trials reported improved survival for left metastatic colorectal cancer (mCRC) in patients that received standard chemotherapy (SC) and either of two biologic therapies (BT) (bevacizumab or cetuximab), compared to SC alone. There is conflicting survival evidence for benefit from the combination of either BT agent with SC for right mCRC.

Specific Aims: To evaluate differences in survival for right vs. left mCRC in patients receiving SC and either BT agent.

Methods: Using California Cancer Registry data (2004-2014), we assessed mortality hazards for mCRC patients by tumor location and BT type. BT type was determined by programmatic and visual review of treatment text fields.

Results: Data for 4,632 patients were available in CCR data. Propensity score adjusted all-cause mortality hazards ratios and 95% confidence intervals for right mCRC patients receiving SC+bevacizumab or SC+cetuximab vs. left mCRC receiving SC+bevacizumab (referent group) were: HR=1.31; 95% CI=1.25-1.36 and HR=1.88; 95% CI=1.68-2.12, respectively. The mortality hazard ratio for left mCRC in patients receiving SC+cetuximab vs. the referent treatment category was: HR=0.97; 95% CI=0.88-1.05).

Discussion: These findings reveal lowest mortality hazards for left mCRC patients receiving SC+ either BT agent, with significantly higher mortality hazards seen for right mCRC patients receiving SC+BT agent, regardless of agent. These findings are similar to those obtained in randomized clinical trials.

Conclusions: These findings show that programmatic and visual review of CCR text fields can be used to glean BT data for mCRC patients receiving SC. Interpreted together with clinical trial findings, these findings support generalizability of evidence for survival benefit for left mCRC patients treated with SC and either bevacizumab or cetuximab.

3E4

LINKAGE BETWEEN UTAH ALL-PAYER CLAIMS DATABASE AND CENTRAL CANCER REGISTRY FOR TREATMENT AND TUMOR MARKER DATA

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Background: Many states are developing All-Payer Claims Databases (APCD) as tools for understanding health care trends and costs. APCD data are potentially valuable for cancer surveillance, but quality for linkage and validity of data have not been evaluated.

Methods: Individuals with first primary invasive cancers of selected sites diagnosed in 2013 at ages 20-64 and reported to Utah Cancer Registry (UCR) were linked to Utah APCD claims using LinkPlus Software. For linked cases, Utah APCD data (inpatient, outpatient, and pharmacy claims) were queried for codes representing cancer treatment, including chemotherapy, hormonal, radiation, and biological response modifiers. Codes for reportable tumor marker assays were queried. An experienced certified tumor registrar abstracted treatment and tumor marker data from electronic medical records for a random sample of breast and colorectal cancer cases for validation.

Results: We were able to link 87.5 % (1,467/1,676) of the eligible UCR cancer cases with APCD claims. Linkage success varied by cancer site and insurance type. The proportion of cases with evidence of treatment increased for all treatment types when APCD claims were added. Sensitivity of the hormonal therapy variable for breast cancer increased from 79% to 95% when APCD data were added, due primarily to APCD pharmacy claims for tamoxifen and aromatase inhibitors. Positive predictive value of APCD therapy variables was high, but manual abstraction revealed that some claims represented therapy that was not first course. APCD claims added data for several tumor markers; for example, the number gastrointestinal cancers with carcinoembryonic antigen (CEA) assays increased 41% when APCD claims were added.

Conclusions: We were able to link a high proportion of cancer cases to Utah APCD, demonstrating that the APCD has high quality identifier data and includes treatment and tumor markers missed in other cancer reporting processes.

E Improving Cancer Treatment Data

11:00am - 12:45pm

3E5

SURVEILLANCE FOR BRCA AND LYNCH SYNDROME TESTING FOR CANCER CASES: REGISTRY ABILITY TO OBTAIN RISK CRITERIA AND GENETIC COUNSELING AND TESTING DATA

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Objective: Most states lack mechanisms for surveillance of genetic counseling and/or testing for individuals who meet criteria for BRCA or Lynch Syndrome (LS) risk. We conducted a pilot surveillance project, addressing the ability of Utah Cancer Registry to determine for those with a diagnosis of cancer: (1) whether the case met criteria for testing, and (2) whether genetic counseling and/or testing occurred.

Methods: We used registry variables and family history information from the Utah Population Database (UPDB) to identify cases meeting National Comprehensive Cancer Network (NCCN) criteria for counseling and/or testing. Experienced Certified Tumor Registrars (CTR) abstracted risk, counseling, and testing variables from medical records.

Results: For cases diagnosed in 2012 and 2013, 990 of 2,726 (36%) breast cancer cases and 117 of 271 (43%) ovarian cancer cases met BRCA risk criteria based on cancer registry variables; family history from UPDB added an additional 16% of breast cancers. For LS, 263 of 1,458 (18%) invasive colorectal cancer cases and 126 of 654 (19%) endometrial cancer cases met criteria based on registry variables, with an additional 8% and 6%, respectively, based on family history. Of 225 BRCA risk cases abstracted, family cancer history was documented in the medical record for 169 (75%), referral to genetic counseling was noted for 59 (26%), and testing was noted for 93 (41%). For 100 LS risk cases, family history was documented for 76, and referral to genetic counseling or testing was made for 18. Case review with genetic counselors improved the CTRs, ability to locate genetic testing data.

Conclusions: NCCN criteria cast a broad net by flagging more than 50% of breast cancers as potential BRCA risk cases. Although medical records contain no structured data on family history, it is well document in medical record text notes. Documentation of genetic testing with no evidence of genetic counseling was found for a number of cases.

3F1S

MEASURING NET CANCER-SPECIFIC SURVIVAL IN BRAIN AND OTHER CNS TUMORS: CAUSE-SPECIFIC SURVIVAL VS. RELATIVE SURVIVAL

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Background: Net cancer-specific survival is measured using two different methods: cause-specific survival (CSS) and relative survival (RS). CSS estimates percent of persons surviving using individual cause of death information, while RS estimates percent of persons surviving using all deaths adjusted for expected deaths generated from life tables. Both methods are valid estimates for measuring net survival and are used widely in medical research. Cancer registry reporting traditionally reports RS rates when describing population-level survival patterns. In these analyses, we compare CSS to RS for specific brain tumor and hematopoietic histologies.

Methods: Using data from 18 SEER registries between 1973-2013, estimates of 5-year RS and CSS in specific brain tumor and hematopoietic histologies were calculated using the actuarial method. To assess how closely the two survival methods corresponded, we calculated the net cancer survival percent difference between the two methods with the following formula: $(CSS-RS)/CSS$.

Results: The net cancer survival percent difference between the two methods was smallest in the following histologies: acute lymphocytic leukemia: 5.5%, ependymoma: 2.9%, and medulloblastoma: 3.6%. The histologies with the greatest percent difference were: acute myeloid leukemia: 20.6%, meningioma: 9.8%, and glioblastoma: 18.18%.

Conclusions: While both CSS and RS aim to quantify net survival, the measurements from these methods tend to differ due to the biases present in both methods. Our data showed that the discrepancies between the two methods were greater in malignant cancers and cancers that commonly occur in adult patients than in non-malignant cancers and cancers that commonly occur in pediatric patients. Appropriate use of CSS and RS requires a detailed understanding of the factors that lead to differences in the measurements obtained from these two methods.

3F2S

STRATIFYING EXPECTED MORTALITY RATES USING INFORMATION FROM A CONTROL GROUP: AN EXAMPLE USING SOCIOECONOMIC STATUS

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Background: Expected mortality rates are commonly used as a comparative rate for measures such as the standardized mortality ratio (SMR) and relative survival, among others, and are usually presented by age, sex, and calendar year. SMRs and relative survival estimates by other factors such as socioeconomic status (SES) can be biased if estimated when expected rates are not stratified by such factors. If data on such factors are not available on a population level, information from a control group could be used to stratify expected rates.

Purpose: To explore two methods which stratify expected mortality rates by factors other than age, sex, and calendar year using information from a control group.

Methods: SES information from 133,361 matched controls of Swedish women with breast cancer were utilized in Poisson models and flexible parametric survival models (FPSM) to estimate the ratio of the mortality rate in the control group and that in the general population by SES. These ratios, or adjustment factors, were estimated whilst accounting for attained age and attained year. The SES-specific expected mortality rates were estimated by combining these with the unadjusted mortality rates. Five-year relative survival for women with breast cancer was calculated using unadjusted and SES-adjusted expected mortality rates.

Results: Both Poisson and FPSM were able to estimate adjustment factors similarly; Poisson models were easier to implement, but the FPSM approach offered the chance to model two timescales simultaneously. The difference in 5-year relative survival of women with breast cancer between SES groups was smaller when using SES-specific expected mortality rates than non-adjusted rates.

Conclusion: Stratifying population life tables using a control group is possible using the methods presented here and increases the possibility of estimating relative survival, SMRs, and other similar measures by non-standard covariates (e.g., SES or ethnicity).

F Student Presentations III

11:00am - 12:45pm

3F3S

LUNG CANCER INCIDENCE, TOBACCO SMOKING AND ENVIRONMENTAL POLLUTANTS: APPLICATION OF BAYESIAN HIERARCHICAL MODELS USING A JOINT MODELING APPROACH

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Background: Recent age-adjusted small-area disease mapping models revealed large variation in lung cancer incidence rates across the county, with significantly elevated rates within the industrial city of Windsor. Air pollution from industrial sources and the world's busiest international border crossing have been of local concern for respiratory health outcomes. However, estimates of associations between lung cancer and air pollution have been limited by a lack of granular estimates of behavioral risk factors such as tobacco smoking.

Purpose: To explore the association of lung cancer risk with relevant behavioral risk factor estimates and air pollutant estimates within the city of Windsor.

Methods: We implement Bayesian hierarchical models for observed lung cancer incidence with behavioral risk factor and air pollutant estimates for small area geographic units (average population 400-700). A joint modeling framework is employed to incorporate variations in risk factor estimates with land use regression-based air pollutant estimates incorporated as fixed effects.

Results: Preliminary results for 2004 to 2008 comparing: (1) an age-adjusted model to (2) an age-adjusted model fitted with nitrous dioxide, sulfur dioxide, toluene, and average household income (proxy for smoking) demonstrate large attenuation in the unexplained rate ratios ("residuals"). Within Windsor, 2004 to 2008 male lung cancer incidence was associated with household income: an 8% reduction in male lung cancer risk for each \$10,000 increase in household income. Results from more comprehensive models using a joint modeling with smoking estimates will be presented.

Discussion: Findings from models using: (1) income as a proxy for smoking, (2) all estimates fitted as fixed effects, and (3) the joint modeling approach to incorporate error in the tobacco smoking estimates will be contrasted. We will discuss the benefits of the joint modeling approach, our learnings and future work.

3F4S

PREGNANCY AND RELAPSE AMONG FEMALE HODGKIN LYMPHOMA PATIENTS

CE Weibull¹, S Eloranta^{1,2}, KE Smedby^{2,3}, M Björkholm³, SY Kristinsson^{3,4}, ALV Johansson¹, PW Dickman¹, I Glimelius^{2,5}

¹Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden; ²Department of Medicine Solna, Clinical Epidemiology Unit, Karolinska Institutet, Stockholm, Sweden; ³Division of Haematology, Department of Medicine, Karolinska University Hospital Solna, Stockholm, Sweden; ⁴Faculty of Medicine, University of Iceland, Reykjavik, Iceland; ⁵Department of Immunology, Genetics and Pathology, Experimental and Clinical Oncology, Uppsala University, Uppsala, Sweden

Background: The incidence of Hodgkin lymphoma (HL) in women is bimodal, with the first peak around 25 years, which precedes and covers the prime childbearing years. As survival from HL has improved over the years, there are an increasing number of survivors today who are interested in becoming pregnant.

Objective: Our primary aim was to study if post-diagnosis pregnancy is associated with relapse among women in remission from HL. We also looked at pregnancy patterns in female HL survivors over time, by clinical characteristics, and contrasted against birth rates in the general population.

Material and Methods: We utilized the rich Swedish population registers together with detailed clinical information collected from patient records. The final study population of HL patients comprised 449 women in remission from their disease. Survival analysis methods were used to estimate rates and hazard ratios.

Results: Among the women with HL, 144 (32.1%) had at least one pregnancy during follow-up. In total, 47 relapses occurred. One (2.1%) of the relapses occurred in a woman with a recent pregnancy. Childbirth rates were initially lower among HL patients compared to the general population, but at around 6 years after diagnosis no differences were observed. Birth rates have increased over calendar time. There were no significant differences seen by clinical characteristics.

Conclusions: There are many factors that should be considered when deciding about future reproduction, but the risk of pregnancy-associated relapse does not need to be considered. Today, childbirth rates among female HL survivors appear comparable to those in the general population after around 6 years' post-diagnosis, irrespective of clinical characteristics.

Publication: Weibull C.E., et al. Pregnancy and the risk of relapse in patients diagnosed with Hodgkin Lymphoma. *J Clin Oncol*, 2016. 34(4): p. 337-344.

4A1

AN INNOVATIVE APPROACH TO DEVELOPING THE SEER-WIDE QUALITY AUDIT PLAN

S Cheng¹, D Dilts¹, K Cronin², P Fearn², E Feuer², S Friedman², C Kosary², C Lam², A Mariotto², S Negoita², V Petkov², L Penberthy²

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Background: Quality assurance and improvement are becoming increasingly critical in an era of expanded context and complexity of population-based research given the large volume of data available. There is a critical need for a systematic evaluation standard for both data at the time of collection and at release to support the demands of the research community.

Purpose: The SEER-wide Quality Audit Plan (QAP) is an innovative approach to systematically evaluate, monitor, and address data quality issues relative to: (1) existing platforms and datasets, (2) new data extraction technologies, (3) opportunities to expand the scope of data collection, and (4) new partnerships with other organizations. QAP provides a framework for verifying and validating that data elements are accurate and structured appropriately to support population-based and clinical research, and statistical reporting.

Methods: A supply chain quality management perspective was utilized as a framework to account for the flow of data, potential injection points for errors, and the relationships across the network of registrars, researcher communities, and standards bodies. A multidisciplinary workgroup was constituted to develop an overarching QAP. Input into the approach included key opinion leaders from both the registry networks and researchers.

Results: The SEER-wide QAP encompasses a risk-based model for defining acceptable quality limits, approaches necessary to evaluate quality levels across SEER datasets, identification of key audit triggers, and standardized protocols to address underlying causes of deficient quality. This work is the initial foray to communicating the QAP and the implementation plan to the cancer surveillance community.

Conclusion: To our knowledge, this approach is the first proactive quality audit plan integrated into a national cancer registry system. The QAP can be utilized to establish benchmarks for quality across the broader cancer surveillance community.

4A2

BREAKING BARRIERS IN DATA QUALITY ASSURANCE AND OPERATIONAL PROCESS IMPROVEMENTS

W Roshala¹

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Background: In preparation for the 2018 data changes, it is imperative that central registries assess current operational practices while conducting data quality activities. How prepared are we organizationally to meet the demands of 2018? What can registries do to assess their readiness? With more of a focus on treatment data, what treatment data should registries review to assess accuracy and completeness? What type of data quality activities can have a long-lasting impact on your registry? These are some of the issues and questions to be discussed.

Purpose: This presentation provides an overview of recent data quality activities developed and implemented by the Cancer Registry of Greater California (CRGC). While the goal is to improve data quality, these activities also provide opportunities to collaborate with other organizations and develop tools to assist registrars in capturing the data correctly at the time of data abstraction and identify operational process improvement efficiencies.

Methods/Approach: Enhanced and alternative methods for conducting quality assurance activities will be discussed. In addition, CRGC's experience in conducting phase III of the SEER Prostate Specific Antigen (PSA) Data Quality Project will be discussed, in which over 20,000 prostate cases diagnosed between 2004 and 2009 were reviewed within an aggressive timeline. Opportunities to collaborate with other organizations to develop improved efficiencies will also be discussed.

Results: The results of various quality assurance activities and subsequent process improvements will be presented, along with lessons learned.

Conclusions/Implications: A diverse and robust data quality assurance plan can position registries to better meet the needs of the future while improving overall data quality, providing educational opportunities as well as identifying operational process improvement efficiencies.

A Data Quality Improvement

10:30am - 12:00pm

4A3

QUALITY OF ELECTRONIC PATHOLOGY (E-PATH) RECORDS: A FUNCTION OF TIME, "X-FACTORS," AND ONE "CONSTANT"**J Harrison**¹¹New York State Cancer Registry, Albany, NY, United States

Background: Increasingly, an emphasis is being placed on e-path records as a source of early case ascertainment. Abstract submissions by facilities (e.g., hospitals) are subjected to national standard edits, while e-path records are not. In NY, the onboarding of pathology laboratories for e-path reporting involves a certification process which entails a detailed quality review of required and recommended data items. In an attempt to monitor and address data quality past the certification date, we developed a systematic way of evaluating e-path records, our 'Quality Report Card' (Card). The Card measures the number of reports received and calculates the percentage of missing and invalid data on required data items. Recently, five hospital-based laboratories received e-path services from one vendor (a constant). The services included daily electronic transmission of e-path records from the facility to NYSCR using the NAACCR Standards Volume V. We took advantage of this controlled experiment.

Purpose: The aim was to evaluate whether data quality for specific data items changes over time (30 days from certification, 90 days, 1 year, and 18 months later) among facilities that use the same vendor.

Method: The Card was run for the facilities for four different timeframes.

Results: Preliminary results show a trend towards missing SSNs the further the timeframe is from certification date (defined as 'go live' into production, having met specified quality criteria). In addition to time from certification, unknown and unanticipated factors, the so called 'x-factors,' such as laboratory information system interface change at one facility, and volume increase for all, played a role.

Conclusions: Specific lessons learned and general implications for central cancer registries regarding variable quality of e-path records (hospital-based and independent) will be presented.

4A4

AUTOMATE AND STANDARDIZE FOLLOW-BACK USING RAPID SOFTWARE DEVELOPMENT PLATFORMS WITH INTERACTIVE ACTIVITY MANAGEMENT IN A SHORT TIMEFRAME**H Kundeti**¹, T Davison¹, D Hintz¹, M Induni¹¹Cancer Registry of Greater California, Sacramento, CA, United States; ²California Cancer Registry, Sacramento, CA, United States

Background: The followback in the Cancer Registry community refers to the various business processes involved in contacting a physician, abstractor, or reporting facility to obtain missing information or to resolve inconsistencies in data. Broadly, followback can be categorized into the hospital followback process and the physician followback process. The three SEER regional grantees in the state of California had different business processes with different modes of followback, including faxing, calling, and secure e-mail based on the preferred mode of response of various followback facilities.

Purpose and Methods: California Cancer Registry and Cancer Registry of Greater California took initiative to standardize followback processes across all three registry grantees. The traditional software development models for the Eureka platform did not meet the rapid development needs of the Cancer community in California. After performing a rigorous business process analysis, a software assessment framework was developed to address the needs of standardization and capabilities required for efficient followback. Using the framework, Microsoft Dynamics Customer Relationship Management software was selected as the preferred software platform.

Implementation/Results: The Microsoft Dynamics platform allowed for rapid software development and in 1 year's timeframe, all the followback processes including hospital followback and physician followback were standardized and automated on an interactive activity management platform with capabilities that include automated e-mails, automated faxes, and automated alerts. Now, all reporting facilities in California have the ability to log on to a portal, find the cases associated with their facility, and resolve or address the cases per requirements and standards set by the California Cancer Registry. This solution is completely customizable and has the capabilities and features to scale up for the benefit of cancer communities and cancer registries.

4B1

THE DEVELOPMENT OF THE CLINICAL DOCUMENT ANNOTATION AND PROCESSING PIPELINE TO FACILITATE THE INTEGRATION OF NATURAL LANGUAGE PROCESSING WITHIN CANCER SURVEILLANCE

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Background: With the growing complexity of cancer diagnosis and treatment, the national cancer surveillance program faces increasing challenges in capturing essential information needed to support a broad variety of cancer research objectives. Unstructured text documents, including pathology reports, clinical notes, and radiology reports, have critical clinical data elements that are not currently collected. The National Cancer Institute's (NCI) Surveillance Epidemiology and End Results (SEER) Program and the Department of Energy (DOE) partnered to utilize high-performance computing to address key cancer surveillance challenges.

Purpose: One objective of the partnership is to develop scalable natural language processing (NLP) and machine learning tools for deep text comprehension of unstructured clinical text to enable accurate, automated capture of reportable cancer surveillance data elements.

Methods: The Clinical Document Annotation and Processing (CDAP) Pipeline infrastructure was developed to provide diverse functionality of clinical document selection and human annotation of key data elements to be used as training datasets for algorithm development. Furthermore, the CDAP pipeline provides the structure for NLP algorithms to be tested and validated, allowing for iterative improvement of those algorithms.

Results: The CDAP pipeline is implemented in four SEER registries and training datasets have been annotated for biomarkers, such as ALK and EGFR. A DOE developed NLP tool to abstract pathology site, histology, laterality, and behavior is being integrated with the CDAP pipeline.

Conclusions: The CDAP pipeline can be utilized to create large annotated datasets and for NLP algorithm development of clinical data elements that are not currently gathered to enhance cancer registry data.

4B2

CREATING AN NLP SERVICE TO CODIFY HISTOPATHOLOGY REPORTS AT THE CALIFORNIA CANCER REGISTRY

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The California Cancer Registry required a Natural Language Processing solution that would identify and codify pathology reports. The attributes to be extracted and coded were Site, Histology, Behavior, Grade, Laterality, and Date, for all tumor streams.

The architecture of HORIZON consists of a pipeline with these components:

- Document classifier to separate reportable cases
- Document classifier to determine out-of-scope reports
- Recognition engine to identify pertinent content
- Extraction engine to extract most relevant information
- Codification engine to infer codes

The document classifier for out-of-scope documents has attained an accuracy of 99% and 93% for histopathology and other (immunohistochemistry and genetics) documents respectively. The non-reportables document classifier is to be evaluated in the last stage of the project. The recognition engine has been developed using a careful sampling of 5,000 reports. These have been manually annotated providing approximately 80,000 semantic tags, and a subsequent language model built using machine learning methods achieved 98.7% accuracy.

The process of coding the tagged content requires evaluating which tagged content is the most appropriate to represent the case and then matching that content to an ICD-O3 code descriptions. This work has reached the required threshold of 90%. The most problematic aspects of the project have been annotating the documents consistently, the particularly poor organization of pathology reports, coalescing the entries from different specimens, and, accurately matching the extracted content to ICD-O3 site and morphology codes.

The CCR has integrated the processes of sending and receiving data to the HORIZON service into their workflow processes. The project has successfully shown NLP technology can provide the accuracy needed to assist cancer registries in a production workflow and we have early inklings that it can improve the quality of their results.

B Natural Language Processing

10:30am - 12:00pm

4B3

REBOOTING CANCER DATA THROUGH STRUCTURED DATA CAPTURE**G Lee**¹, S Jones², W Blumenthal², R Moldwin³, D Kwan¹¹Cancer Care Ontario, Ontario, Canada; ²Centers for Disease Control and Prevention, Atlanta, GA, United States; ³College of American Pathologists, Chicago, IL, United States

Background: Through the work of the North American Association of Central Cancer Registries organization, the cancer registry community has historically harmonized data collection needs across multiple standard setters. This has positioned the cancer registry community ahead of other public health domains for standardization across the healthcare community. The movement toward standardized electronic health records (EHRs) is opening the door to data that can enhance and expand the use of our cancer registry data for surveillance and for evidence-based decision making at a system level.

Purpose: The cancer registry community requires technical specifications and tools to collect and analyze a much wider variety of patient data with improved data standardization and increased collection efficiency.

Methods: With improvements in EHRs and the recent implementation of structured, synoptic reporting in cancer care (including radiology, surgery, and pathology), cancer registries are beginning to adopt new solutions to improve real-time data collection. We adopted CAP's electronic cancer checklist (eCC) templates, a new Cancer Care Ontario (CCO) radiology reporting template, NAACCR Vol V eCC data transmissions, and are implementing the new IHE Structured Data Capture model to support the capture, transmission of quality indicators, and highly structured and synoptic data sets to CCO.

Results: We will describe the current state of structured data capture with pathology resection and biomarker reporting as well as CCO's activities related to synoptic reporting for radiology and other areas of the cancer continuum. We will also describe CDC's eMaRC Plus synoptic reporting update which can capture, parse, and store new types of registry data.

Conclusion: This presentation demonstrates how to improve management of standardized cancer data, including quality indicators.

4B4

DEVELOPMENT OF A NATURAL LANGUAGE PROCESSING (NLP) WORKBENCH WEB SERVICES TO MAP UNSTRUCTURED CLINICAL INFORMATION TO STANDARDIZED CODED DATA**S Jones**¹, T Botsis², J Patrick^{3,4}, K Kreimeyer², M Foster², A Pandey², N Arya², M Walderhaug², G Zhang⁵, W Chen⁵, W Wang⁵, M Caldas⁴, S Baral⁴, S Campbell⁴, W Blumenthal¹, J Rogers¹¹Centers for Disease Control and Prevention, Atlanta, GA, United States; ²U.S. Food and Drug Administration, Silver Spring, MD, United States; ³Health Language Analytics, Sydney, Australia; ⁴Northrup Grumman, Atlanta, GA, United States; ⁵Engility Corporation, Silver Spring, MD, United States

Background: While Meaningful Use and other activities have increased the use of standardized Electronic Health Record (EHR) systems, there continue to be components of the medical records, laboratory reports, and other clinical reports that are free-form text. Similarly, clinical information submitted to the U.S. Food and Drug Administration (FDA) Spontaneous Reporting Systems for drugs, vaccines, and blood products may be missing structured information or may contain inappropriate codes from the Medical Dictionary for Regulatory Activities terms.

Purpose: The Assistant Secretary for Planning and Evaluation funded FDA and CDC to develop a Natural Language Processing (NLP) Workbench on a shared web service platform for patient-centered outcomes research (PCOR) researchers, as well as federal and public health agencies at all levels. Access to NLP and machine learning tools need to develop and share language models that map unstructured clinical text to standardized coded data.

Methods: The FDA and CDC have completed a literature review and environmental scan of open source NLP solutions to identify tools that can be included in the Workbench. To demonstrate use of the Workbench, the FDA will use surveillance data for blood products and vaccines and the CDC will use pathology reports for cancer surveillance. The NLP Workbench will be architecturally designed to provide the tools needed for development of new language models, and operate as a public web service so that any registered user may process their own unstructured data.

Results: This presentation will provide information on the literature review, environmental scan, architectural design, stakeholder input, and methods to test, evaluate, and implement the NLP Workbench.

Conclusion: The NLP Workbench will be used to develop shared language models for public web services to process text and return a set of data elements with coded data values for use by researchers and public health professionals.

4C1

VIRTUAL POOLED REGISTRY UPDATE: BREAKING DOWN BARRIERS TO MULTI-REGISTRY RESEARCH LINKAGES AND BUILDING CAPACITY FOR FUTURE INITIATIVES

C Clerkin¹, L Penberthy², B Kohler¹, D Deapen³, R Sherman¹

¹North American Association of Central Cancer Registries, Inc., Springfield, IL, United States; ²National Cancer Institute, Bethesda, MD, United States; ³Los Angeles Cancer Surveillance Program, Los Angeles, CA, United States

Background: Designed to facilitate multi-registry cohort linkages that will enhance linkage results while increasing the efficiency for both researchers and central cancer registries, the Virtual Pooled Registry Cancer Linkage System (VPR-CLS) has made significant progress since receiving dedicated project funding from NCI in 2015.

Purpose: Authors will provide an update on progress in developing the VPR-CLS and discuss exciting opportunities for additional uses and benefits for cancer research.

Methods/Approach: Development of the VPR-CLS has proceeded in a step-wise fashion by engaging registries, researchers, and external stakeholders. Each step was designed to test methods, identify best practices, and reduce barriers to accessing data across multiple registries. A user-friendly fully electronic research application portal and processes for data exchange have been developed to support the VPR-CLS activities.

Results: Linkage results and cost benefits based on two pilot linkages between large research cohorts and over 40 registries were summarized, systems to link and process data were developed and tested, encrypted inter-registry linkages were performed, templated IRB forms were created, and registry focus groups were initiated for feedback on funding options. Plans for new initiatives include definitive testing of encrypted inter-registry linkages for deduplication and more accurate assessment of multiple primary cancer incidence and development of a central IRB for use by investigators in the VPR-CLS.

Conclusions/Implications: The VPR-CLS has made significant progress demonstrating efficiencies and cost-savings for registries and researchers participating in large cohort linkages. The preliminary results suggest that this system will be beneficial to improving outcomes assessment for clinical trials, including millions of patients in cohort studies funded by the NCI, and for improving data accuracy and statistics for routine cancer surveillance.

4C2

BREAKING BARRIERS FOR CENTRAL CANCER REGISTRY-BASED RESEARCH: THE NEW NIH POLICY ON USE OF A SINGLE INSTITUTIONAL REVIEW BOARD FOR MULTI-SITE RESEARCH

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¹Los Angeles Cancer Surveillance Program, Los Angeles, CA, United States; ²North American Association of Central Cancer Registries, Inc., Springfield, IL, United States; ³Surveillance Research Program, National Cancer Institute, Bethesda, MD, United States

Background: Central cancer registries are increasingly recognized for their critical contributions to cancer epidemiology cohorts as well as other public health roles such as post market surveillance of drugs and devices. A new NIH policy is intended to facilitate the approvals process for these studies.

Purpose: NAACCR has been developing the Virtual Pooled Registry Cancer Linkage System (VPR-CLS) to reduce the barriers that researcher face when conducting linkage studies with multiple cancer registries. Those barriers—which result in years of delay and thousands of dollars in costs—largely involve the required Institutional Review Board (IRB) review and approval processes which differ for each state.

Approach: Recognizing the impact of multiple IRB reviews for the same protocol, the National Institutes of Health (NIH) published a Final Policy on the “Use of a Single Institutional Review Board for Multi-Site Research.” Effective May 25, 2017, the policy states “all sites participating in multi-site studies involving non-exempt human subjects research funded by the NIH will use a single Institutional Review Board...” NIH believes that this will “enhance and streamline the process of IRB review and reduce inefficiencies so that research can proceed as expeditiously as possible without comprising ethical principles and protections for human subjects.”

Results: The VPR-CLS developers seek to help researchers, central cancer registries, and local IRBs comply with this requirement. Initiatives include: (1) developing policy guidance for minimal risk registry linkage studies, (2) integrating this approach into the VPR-CLS central application process, and (3) establishing a single IRB dedicated solely to registry linkage research.

Implications: With the compliance deadline of May 2017, NAACCR seeks to provide support to the research and registry communities. Initiatives to help achieve compliance will be presented and input from researchers and registries will be solicited.

C Virtual Pooled Registry Cancer Linkage System

10:30am - 12:00pm

4C3

USING THE VIRTUAL POOLED REGISTRY-CANCER LINKAGE SYSTEM FOR INTERSTATE DEDUPLICATION

C Johnson¹, R Rycroft², B Kohler³, W Howe⁴, A Lake⁴, C Clerkin³, R Sherman³

¹Cancer Data Registry of Idaho, Boise, ID, United States; ²Colorado Central Cancer Registry, Denver, CO, United States; ³North American Association of Central Cancer Registries, Inc., Springfield, IL, United States; ⁴Information Management Services, Inc., Rockville, MD, United States

Background: A potential use of the NAACCR Virtual Pooled Registry-Cancer Linkage System (VPR-CLS) is to facilitate linkages among central registry databases. National-level deduplication is a requirement for a true national dataset and accurate national-level surveillance statistics.

Purpose: The Colorado and Idaho central cancer registries participated in a pilot project to evaluate interstate deduplication using cryptographically hashed data and compared the results to probabilistic record linkage.

Methods: The two registries provided cryptographically hashed datasets to staff at Case Western Reserve University who performed the deduplication using a HIPAA compliant process. Registry personnel then met at the National Cancer Institute to conduct a separate "Gold Standard" linkage between their registry databases using probabilistic record linkage software (Link Plus).

Results: The hashed deduplication identified 59 person-matches between Colorado and Idaho. Link Plus identified the same 59 matches and 6 additional matches, yielding a sensitivity rate for the hashed deduplication of 90.8% (95% CI: 81.0 – 96.5%). Among the 59 person matches identified via the hashed approach, the registries adjudicated cases by looking up each person in their registry databases. One or more duplicate cases were found for 19 persons; 11 persons had likely duplicate cases that would require additional review; 29 persons had different (multiple) primaries in the two states. 10% of matched pairs were "death certificate only" cases.

Conclusions: This pilot project provided pertinent information for future use of the VPR-CLS in interstate deduplication. Benefits of widespread implementation of interstate linkages include improved data quality and more accurate incidence, survival, and prevalence statistics. Knowledge of other primary cancers in patients who move to other states can also be used to identify patients who are at increased risk for hereditary cancer syndromes.

4C4

VIRTUAL POOLED REGISTRY LINKAGE SOFTWARE

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¹IMS, Inc., Rockville, MD, United States; ²National Cancer Institute, Bethesda, MD, United States

Background: A key component to the Virtual Pooled Registry Cancer Linkage System (VPR-CLS) is the linkage software system used by registries. The linkage software will ensure standardized linkages across registries, process linkages in a timely manner, provide summary frequency counts, and include an interface to manually adjudicate potential matches. Existing linkage software products were unable to meet the needs of the project.

Purpose: Authors will provide updates on the progress in developing a linkage software for the VPR-CLS and other registry related linkages.

Methods: Development of the linkage software has been a step-wise process that involved testing several different existing linkage software tools before determining that it was necessary to create a tool that incorporated features from existing software, and added new features to fulfill the VPR-CLS needs. The approach to development required input from the VPR-CLS linkage subgroup and statisticians from the Surveillance Research Program at the NCI.

Results: The new linkage software under development is a feature-rich tool that enables users to customize blocking sensitivity, comparator options, field weighting, and match acceptance scenarios. These options allow the VPR-CLS to establish linkages which optimize high quality matches and improve linkage processing speeds. In addition to the custom link features, the software has a manual reviewer to assist with linkage adjudication and a report module for generating summary and frequency statistics.

Conclusions: The VPR-CLS has made significant progress demonstrating efficiencies in performing linkages. Investigating and developing linkage software with the computational requirements necessary to attain high quality and efficient linkages is critical for ongoing VPR-CLS success. The flexibility and efficiency of the new software under development make this a valuable tool available to researchers performing linkages outside of the VPR-CLS.



4D1

VISUAL DISPLAY AND ANALYSIS OF GEO-REFERENCED CANCER DATA MADE EASY WITH NEW R PACKAGES - APPLICATIONS

L Pickle², J Pearson², L Zhu¹

¹National Cancer Institute, Bethesda, MD, United States; ²StatNet Consulting LLC, Gaithersburg, MD, United States

Cancer registry staff have always been interested in identifying emerging high-rate cancer clusters or changing time trends by region within their registry area as part of their surveillance activities. Until recently, cancer “hot spots” were typically identified by concerned citizens worried about an excess of cancer in their neighborhood. Now, you can explore the geographic patterns of cancer in your own registry area using GIS software. However, this software has a steep learning curve and registries often cannot afford to have a staff person dedicated to mapping tasks. We have developed several packages using R that allow the mapping and visual exploration of spatial clusters and spatial correlations with minimal coding required. In this talk we will illustrate how these packages can be applied to geo-referenced cancer data.

The SeerMapper package produces maps at the state, registry, county, and census tract levels for the U.S. All boundary files are included. The resulting maps are limited to the geographic area for which data are present.

The satscanMapper package reads the text output of the SaTScan™ cluster analysis package and creates maps of results at the state, county, or tract level. Cluster outlines are overlaid on the maps. A summary text report summarizes the clusters in a geographic hierarchy.

The micromapST package produces linked micromaps, a design which links graphical elements with a series of small maps to facilitate exploration of spatial data. Multiple data columns are displayed simultaneously with the maps, enabling comparison of spatial patterns and visual identification of correlations across the columns. The new package can display any geo-identified data for which boundary files are provided. Included with the package are boundaries for U.S. states, SEER registries, counties within select states and Chinese provinces.

This talk will emphasize the applications of these packages. Following talks will describe how to implement them.

4D2

AN INTRODUCTION TO USING R FOR MAPPING TOOLS

L Zhu¹, D Buckman²

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R is an open source software that performs tasks beyond just statistical analysis. Through user contributed packages, it has become very popular in many fields. The series of mapping tools presented in this session is developed in R. The purpose of this talk is to provide a fundamental tutorial of R to get users started in using these mapping tools. Basic topics include: downloading and installing R; basic commands to input data, install a package, and run a package; output data and graphs in R; how to find help; and resources on the Internet.

D GIS Mapping Tools

10:30am - 12:00pm

4D3

MAPPING TOOLS FOR THE VISUAL DISPLAY AND ANALYSIS OF GEO-REFERENCED CANCER DATA AND EXAMPLES.**J Pearson**², L Pickle², L Zhu¹¹National Cancer Institute, Bethesda, MD, United States; ²StatNet Consulting LLC, Gaithersburg, MD, United States

In the exploration and analysis of spatial cancer data, being able to easily and quickly visualize spatial patterns in the data is important. Most solutions require programming experience or a lot of graphics knowledge. Several R packages have been developed to simplify this task for state, registry, county, or census tract areas, letting users focus on the analysis and spatial aspects of the data. The packages contain all you need—the code and boundary data. During this talk, the steps to use each package will be demonstrated. The packages reviewed are:

- 1) SeerMapper – Categorize and map data at the state, SEER registry, county, and census tract levels.
- 2) satscanMapper – Create maps from the spatial and space-time analysis results from a SaTScan™ cluster analysis at the state, county or tract level and produce a combined view of the clusters using a state, county, place and tract hierarchy.
- 3) micromapST – Review the package's features and how to get a quick start making linked-micromaps at the state, registry, and counties within a state level.

The first step is to build a description of the linked micromap (the panelDesc table). Then, the data and the description are passed to micromapST to produce the graphic. Each available graphical element (maps, arrow, bar, dot (several variations), segmented, normalized and centered stacked horizontal bars, boxplots, scattered dot, and time-series lines) will be briefly discussed to show how they can improve the understanding of the data. Next, the examples will be modified to show of how work with the graphics and make enhanced with just a few changes.

The goal is to provide the audience with a foundation to quickly create maps and to explore patterns in their own data. No R experience is required.

4D4

STANDARDIZING ADDRESS CLEANING FOR GIS MAPPING**C Lefante**^{1,2}, L Maniscalco^{1,2}, K Henry³, D Stinchcomb⁴, W Xiao-Cheng^{1,2}¹Louisiana Tumor Registry, New Orleans, LA, United States; ²Louisiana State University Health Sciences Center; School of Public Health, New Orleans, LA, United States; ³Temple University, Philadelphia, PA, United States; ⁴Westat, Rockville, MD, United States

Background: The Louisiana Tumor Registry (LTR) partners with the Louisiana Colorectal Cancer Roundtable (LCCRT) to map late-stage colorectal cancer cases to identify focus areas to achieve the “80% CRC screening goal by 2018.” This undertaking identified some inconsistencies in determining the residential address at time of diagnosis.

Purpose: To establish guidelines for the retrospective cleaning of address at diagnosis.

Methods: The precision of GIS mapping is dependent on the quality of the address location coordinates. In any given year, 5% of cases in Louisiana will have only a PO box or rural route for an address. In addition, yearly quality control activities identify 2% of cases with addresses that are unrecognizable by the NAACCR Aggie geocoder due to typos and data entry error. In 2016, LTR began developing guidelines for address recording and cleaning that could standardize the practice throughout the state. These guidelines established the process for determining residency from voter registration, as well as when it is appropriate to use the address from a death certificate. The guidelines also encourage use of the USPS database in verifying street names and numbers.

Results: Through Internet and data linkage resources, LTR was able to establish a hierarchy for choosing the most accurate and appropriate address at diagnosis, in particular when only a PO box/ rural route had been reported. We will present the inclusion criteria and demonstrate its improved accuracy in mapping.

Conclusions: The importance of the complete and accurate collection of address data will only grow as we utilize GIS mapping increasingly to inform programmatic decision-making for cancer control. Standardization is necessary to create accurate GIS maps that can best direct time and resources to cancer control and prevention activities.

4E1

THE INFLUENCE OF NATIVITY, NEIGHBORHOOD SOCIOECONOMIC STATUS, AND ETHNIC ENCLAVE ON MORTALITY AMONG HISPANIC AND ASIAN AMERICAN/PACIFIC ISLANDER WOMEN DIAGNOSED WITH ENDOMETRIAL CANCER IN CALIFORNIA DURING 1988–2011

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Objective: Mortality from endometrial cancer (EC) has been increasing in the United States (U.S.), disproportionately affecting racial/ethnic minorities. We aimed at investigating the influence of nativity and neighborhood social factors on the mortality of Asian American/Pacific Islander (AAPI) and Hispanic women with EC.

Methods: Using data from the statewide California Cancer Registry enhanced with linkage to the small area contextual level data from California Neighborhood Data Systems, we characterized the neighborhood SES (nSES) and ethnic enclave environment for 9,339 Hispanic and 5,821 AAPI women diagnosed with EC from 1988 through 2011. Cox proportional hazard models were used to estimate the association between the risk of death (all-cause and endometrial cancer-specific [ECS] mortality) and nativity and neighborhood social factors (nSES and ethnic enclave), adjusting for patient, tumor, and treatment characteristics for each race/ethnicity.

Results: Approximately 49% of Hispanics and 73% of Asians were foreign born. Among Hispanics, foreign-born women had 18% and 16% lower risk of all-cause and ECS mortality, respectively, than U.S.-born women (HR=0.82; 95% CI: 0.76–0.89 and HR=0.84; 95% CI: 0.74–0.96, respectively). Hispanics women living in the lowest SES neighborhoods had a 27% increased all-cause mortality risk compared to those living in the highest SES neighborhoods (p-trend<0.0001). In contrast, among AAPIs, there were no significant associations between nativity and nSES and all-cause or ECS mortality risk. For both Hispanic and AAPI women, ethnic enclave was not significantly associated with either all-cause or ECS mortality risk.

Conclusion: Nativity (U.S. born) and lower nSES were significantly associated with higher risk of death among Hispanic women with endometrial cancer. Our study emphasizes the need to better investigate and address disparities in mortality among the most vulnerable Hispanic women with endometrial cancer in California.

4E2

HOW MUCH OF THE RACIAL/ETHNIC DISPARITIES IN CANCER SURVIVAL IN CALIFORNIA IS EXPLAINED BY DIFFERENCES IN TUMOR, SOCIODEMOGRAPHIC, INSTITUTIONAL, AND NEIGHBORHOOD CHARACTERISTICS? A MEDIATION ANALYSIS

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¹Cancer Prevention Institute of California, Fremont, CA, United States; ²Stanford Cancer Institute, Stanford, CA, United States

Racial/ethnic disparities in cancer survival in the U.S. are well documented, but the underlying causes are not well understood. In order to reduce racial/ethnic disparities in outcome, it is vital to better understand what is contributing to them. We investigated racial/ethnic survival disparities for the four most common cancers in California, and quantified the contribution of various factors including tumor, treatment, hospital, sociodemographic, and neighborhood characteristics to these disparities in survival.

Tumor records from the California Cancer Registry were used to estimate population-based cancer-specific survival by racial/ethnic group for patients diagnosed between 2000-2013 with female breast, prostate, colorectal, or lung cancer. Various covariables were considered as potential mediators in the relationship between race/ethnicity and survival. The relative contribution of these factors to survival disparities was investigated using a sequence of multivariable Cox Proportional Hazards models.

NH black patients had the lowest survival for all cancer sites, and AAPI patients the highest, compared to NH whites. Stage at diagnosis had the greatest influence, reducing overall racial/ethnic disparities by 24% for breast, 24% for prostate, and 16-30% for colorectal cancer. Hormone receptor status was the second largest contributor to disparities in breast cancer survival. Neighborhood SES was an important mediator for all cancers, but only for NH black and Hispanic patients (compared to NH white). Differences in SES accounted for ~18% of lung cancer survival disparities. Marital status also influenced racial/ethnic disparities, particularly in men.

The relative influence of mediators varied by racial/ethnic group. Overall reductions in racial/ethnic survival disparities were largely driven by reductions for NH black patients. There was little mediating effect on the AAPI survival advantage, due to a similar sociodemographic profile to NH whites.

E Cancer Disparities - SES

10:30am - 12:00pm

4E3

TREATMENT DISPARITIES FOR PATIENTS DIAGNOSED WITH METASTATIC BLADDER CANCER IN CALIFORNIA: CONTRIBUTION OF SOCIOECONOMIC FACTORS AND MARITAL STATUS

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Background: Approximately 4% of all bladder cancer (BCa) patients are diagnosed after the cancer has metastasized to other parts of the body, and survival for these patients is poor. Disparities in receipt of treatment by race have been shown to contribute to disparities in survival, but less is known about the impact of socioeconomic status (SES).

Purpose: The objective of this study was to identify disparities in chemotherapy receipt for patients with metastatic BCa by race and SES.

Methods: Patients with metastatic BCa (remote summary stage) diagnosed between 1991 and 2014 were identified through the California Cancer Registry. Possible predictors of receipt of chemotherapy (yes/no), including age at diagnosis, sex, race/ethnicity, area-based SES, and marital status, were evaluated using logistic regression.

Results: A total of 2,887 cases of metastatic BCa were identified. Among these cases, 67.3% were male, and 51.7% were married. The race distribution was 74.7% non-Hispanic (NH) white, 6.2% NH black, 12.5% Hispanic and 6.1% NH Asian/Pacific Islander. Female patients were more likely not to receive chemotherapy (OR=1.4, CI= 1.2-1.7), and black patients were slightly more likely not to be treated (OR=1.3, CI= 0.97-1.8). Most striking was the interaction of marital status and neighborhood SES. Compared to married patients in the highest SES group, married patients in the lowest SES group were 2.5 times more likely not to receive chemotherapy (95% CI: 1.7- 3.7), and unmarried patients in the lowest SES quintile were 3.6 times more likely not to receive chemotherapy (95% CI: 2.5-5.1). Analysis of the contribution of these factors to survival is ongoing.

Conclusion: Patients residing in low SES neighborhoods, particularly unmarried patients, were less likely to receive chemotherapy. These results may reflect differences in social support as well as healthcare access and utilization.

4E4

ADDRESSING RACIAL DISPARITIES IN BREAST CANCER TREATMENT DELAYS: AN APPLICATION OF GROUP MODEL BUILDING

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Background: Racial disparities in breast cancer (BC) in St. Louis, Missouri, are consistent with patterns seen throughout the US, however, there is great regional variation in mortality. Women with BC residing in North St. Louis, a predominantly black community, experience the highest rates of mortality.

Methods: Group model building (GMB) is a participatory method for actively engaging stakeholders in modeling a complex system. Three 2-hour GMB sessions were conducted with: (1) community support members (n=6), (2) black women from the community (n=34), and (3) both groups combined. The objective of sessions 1 and 2 was to elicit factors contributing to BC diagnosis and treatment delays and develop a dynamic hypothesis to explain the disparities in the form of a causal loop diagram (CLD), a causal map that visualizes how system variables are interrelated. In the third session participants evaluated a synthesized CLD and identified places to intervene.

Results: Women built a CLD that included subsystems mental health, fear, access to care, income, religion/spirituality, social support, knowledge on breast health and personal mindset on health/life. These subsystems are causally-linked and include feedback loops, providing explanations for trends in BC diagnosis and treatment delays in St. Louis. Women also identified a set of recommendations for action based on this structure.

Conclusion: Findings shed light on the experiences of the women by enhancing our understanding on factors contributing to BC racial disparities. It is also serving as a tool to voice involvements of women in developing effective interventions for BC diagnosis and treatment delays.

4E5

PATIENT AND HOSPITAL CHARACTERISTICS ASSOCIATED WITH NEPHRON-SPARING SURGERY FOR SMALL, LOCALIZED KIDNEY CANCERS IN CALIFORNIA, 2012-2015

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Background: The increase in kidney cancer incidence in the U.S. has been attributed, in part, to increased incidental detection of small, localized tumors. Complete nephrectomy (CN) was the gold standard for treating all renal masses from the 1960s through the 1990s. In the early 2000s, studies showed that patients with localized renal tumors ≤ 7 cm, treated with nephron-sparing surgery (NSS), had similar oncologic outcomes, enhanced preservation of renal function, and better overall survival compared to patients treated with CN. Despite its well-documented advantages, NSS continues to be underutilized. This study evaluated patient and hospital characteristics associated with NSS for small, localized kidney cancers in California. **Methods:** Malignant T1a and T1b kidney tumors, diagnosed and treated with nephrectomy between January 1, 2012 and December 31, 2015 were identified using California Cancer Registry data. The hospital that performed the surgery was identified and hospital characteristics were obtained from the Office of Statewide Health Planning and Development (OSHPD). Multivariate logistic regression was used to determine the association of patient, tumor, and hospital characteristics with NSS.

Results: Of the 8,604 tumors meeting inclusion criteria, 5,245 (61%) were treated with NSS and 3,359 (39%) with CN. Preliminary results indicate that patients who were white, less than 65 years old, had private health insurance, no comorbidities, smaller tumors, and low grade tumors were significantly more likely to be treated with NSS. Patients treated in NCI designated comprehensive cancer centers, urban hospitals, and hospitals performing more than 55 nephrectomies per year were more likely to be treated with NSS.

Conclusion: Patients diagnosed with small, localized kidney cancers in California between 2012 and 2015 were more likely to be treated with NSS than CN; however, there were significant disparities in the likelihood of receiving NSS.

F New Data Uses

10:30am - 12:00pm

4F1

DATA VISUALIZATION ASSESSMENT OF THE NATIONAL PROGRAM OF CANCER REGISTRIES (NPCR) PROGRAM EVALUATION INSTRUMENT (PEI)M Wu¹, V Benard¹, T Williams¹, **S Van Heest¹**, M Freeman²¹Centers for Disease Control and Prevention, Atlanta, GA, United States; ²Orise Fellow, Atlanta, GA, United States

Introduction: The National Program of Cancer Registries (NPCR) uses the Web-based Program Evaluation Instrument (PEI) every 2 years to assess performance, operations, and adherence to national program standards of its 48 funded central cancer registries (CCRs). The PEI provides information about CCR advanced activities and provides feedback that help in maintaining registries with high-quality data.

Purpose: The PEI is based on CDC's Updated Guidelines for Evaluating Public Health Surveillance Systems and monitors the integration of surveillance, registry operations and health information systems, the usage of established data standards, and electronic data exchange.

Method: This presentation will explore multiple PEI assessments using data visualizations in Tableau to explore possible trends in staffing, administration, data exchange, data quality, data use, collaborative relationships, advanced activities, and other assessments. Data visualizations for the previous four PEI assessments will be shown and will focus on answering grantees' most frequently asked questions. Interactive data visualization worksheet dashboards will be created that present complex data more clearly to facilitate decision making in a timely matter.

Results: Results from the PEI can be used to develop a better understanding of the current status of the NPCR registries and help inform the NPCR CCRs of possible trends in their own registry operations and comparisons with other registries. Past analyses of the PEI evaluations have shown trends in the types of activities pursued in the CCRs and confirm that CCRs meet or exceed NPCR program standards related to reporting completeness, data exchange, and data quality assurance independent of the size of the CCR.

Conclusion: Interactive data visualizations of past PEI assessments can provide valuable insight to the CCRs on how other registries are adapting as requirements evolve.

4F2

CASE INVESTIGATION OF CERVICAL CANCER (CICC) STUDY IN THREE U.S. CANCER REGISTRIESV Benard¹, A Greek², A Crawford¹, A Stroup⁵, X Wu³, G Alverson⁴, C Thomas¹, M Watson¹¹Centers for Disease Control and Prevention, Atlanta, GA, United States; ²Battelle, Seattle, WA, United States; ³Louisiana State University Health Sciences Center, New Orleans, LA, United States; ⁴Michigan Department of Health and Human Services, Lansing, MI, United States; ⁵The State University of New Jersey, Newark, NJ, United States

Background: There are about 12,000 women diagnosed with invasive cervical cancer in the U.S. each year and 4,000 die from the disease. Every case represents a potential missed opportunity of proven public health interventions including vaccination and appropriate screening and timely follow-up. Prior studies identified gaps in cervical cancer screening knowledge among patients in managed care environments, but the findings may not be generalizable to the entire population or across health care settings. The purpose of this study is to assess: (1) cervical cancer screening and follow-up in different health care settings, and (2) patients' self-reported barriers and facilitators to screening and care 5 years prior to cancer diagnosis.

Methods: Three population-based central cancer registries (Louisiana Tumor Registry, Michigan Cancer Surveillance Program, and New Jersey State Cancer Registry) will identify women diagnosed with invasive cervical cancer in 2014-2016, facilitate enrollment of patients who consent to participate, and perform all data collection and primary data entry. Medical charts in the 5 years prior to diagnosis will be reviewed for screening history, follow-up of abnormal results, and any additional information related to the initial cancer diagnosis and screening. Participating patients will also be contacted via mail survey and phone follow-up to elicit information on vaccination, barriers or facilitators to screening and care.

Results: A total of 1,670 women have been identified as potentially eligible for this study. We will begin patient enrollment and data collection in early 2017. This study will identify barriers to screening and follow-up from survivors' perspectives, as well as related medical issues.

Conclusion: Findings from this study will provide important information for public health prevention programs to implement effective interventions to address barriers to screening and follow-up and reduce the burden of cervical cancer.

4F3

MEANINGFUL USE PHYSICIAN REPORTING: SUCCESSES AND LESSONS LEARNED

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Background: The Stage 2 Meaningful Use (MU) of Electronic Health Records (EHRs) final rule included an optional objective for ambulatory providers to report cancer cases to central cancer registries. The MU Stage 3 rules were released in October 2015; cancer reporting is now part of Specialized Registry Reporting for Modified Stage 2 and Public Health Registry Reporting for Stage 3.

Purpose: To discuss progress to date on implementing MU cancer reporting, including the successes and lessons learned through collaborative efforts with EHR vendors and state cancer registries. We will discuss both short and long term plans to address reporting issues.

Methods: CDC and NAACCR have worked with the cancer registry community, EHR vendors, Office of the National Coordinator for Health Information Technology, CMS, and other partners to prepare for and support implementation of electronic physician reporting to cancer registries.

Results: EHR vendors have made significant improvements to their systems that are reflected in fewer structural and content errors seen during testing and validation. CDC identified bugs and enhancements for eMaRC Plus and CDA Validation Plus and the need to build a better validation tool for Stage 3 MU implementation. Documents and guidance have been developed and will be improved to help address specific vendor workflow issues. Long term solutions include use of HL7 Fast Healthcare Interoperability Resources (FHIR) and Structured Data Capture, which will enable CDC and registries to include more requirements around workflow.

Conclusions: Collaborative activities of CDC and the cancer registry community are needed for successful implementation of electronic physician reporting.

4F4

USING THE NATIONAL PROGRAM OF CANCER REGISTRIES TO MONITOR TOBACCO USE

D Siegel¹, S Henley¹, J Wike¹, A Ryerson¹, L Pollack¹

¹Centers for Disease Control and Prevention, Atlanta, GA, United States

Background: If public health professionals had access to high-quality tobacco use data from cancer registries, they could better describe tobacco use as a risk factor in epidemiologic studies, understand its impact on disease prognosis, and identify patients for cessation interventions. However, cancer registries do not consistently collect tobacco use data. As part of a larger Comparative Effectiveness Research project, central cancer registries in 10 National Program of Cancer Registries (NPCR) states piloted tobacco use variables.

Purpose: We evaluated the capture of tobacco use data collected by registries to inform recommendations on how best to collect these data for all NPCR registries.

Methods: Participating registries collected data about tobacco use—cigarettes, “other smoked” tobacco, and smokeless tobacco—on cases diagnosed during 2011–2013. Tobacco use codes included never, current, former, and unknown. We used SEER*Stat to analyze the prevalence of known tobacco use by anatomic site and state. We calculated coding quality by dividing the number of cases coded with known values by the total number of cases.

Results: Among 1,646,505 incident cancer cases, coding quality for cigarette use was 51%, of which 18% were coded as current smokers, 30% as former smokers, and 52% as never users. Coding quality of “other smoked” and smokeless tobacco was both 43%, with 97% and 98% coded as never users, respectively. Coding quality ranged from 27% to 81% in the participating registries. Coding quality improved from 47% in 2011 to 59% in 2013. Lung and laryngeal cancers had the highest coding quality and prevalence rates for tobacco use.

Conclusions: Cigarette use was captured on over half of new cancer cases, while “other smoked” and smokeless tobacco had lower coding quality, and fewer current or former users. Focusing on collecting cigarette smoking data in future tobacco-related efforts may expand the public health usefulness of cancer registry data.

A Colorectal Cancer

1:30pm - 3:00pm

5A1**KRAS TESTING, TUMOR LOCATION AND SURVIVAL IN STAGE IV COLORECTAL CANCER PATIENTS: SEER, 2010-2013****M Charlton**¹, A Kahl¹, A Greenbaum², J Karlitz³, C Lin⁴, C Lynch¹, V Chen⁵¹University of Iowa College of Public Health and the Iowa Cancer Registry, Iowa City, IA, United States; ²University of New Mexico School of Medicine, Albuquerque, NM, United States; ³Tulane University School of Medicine, New Orleans, LA, United States; ⁴University of Nebraska College of Medicine, Omaha, NE, United States; ⁵Louisiana Tumor Registry and Epidemiology Program, New Orleans, LA, United States**Background:** KRAS mutations and tumor location have been associated with response to targeted therapy among stage IV colorectal cancer patients in recent clinical trials.**Purpose:** We aimed to conduct the first population-based examination of associations between KRAS mutations, tumor location and survival, and assess trends and factors associated with documented KRAS testing.**Methods:** Cases of stage IV adenocarcinoma of the colon/rectum diagnosed from 2010-2013 were extracted from SEER data. Analyses of patient characteristics, KRAS testing, and tumor location were conducted using Chi-square tests and logistic regression. Cox proportional hazards models were used to assess relationships of KRAS mutations, tumor location and risk of all-cause death.**Results:** Of 22,542 cases, 30% received KRAS testing; 44% of those had mutations. Those tested tended to be younger, married, metropolitan area residents, and have private insurance or Medicare. Rates of KRAS testing also varied by registry (range: 20-46%). Those with right-sided colon cancer compared to left-sided colon cancer tended to be older, female, black, have mucinous, KRAS-mutant tumors, and had a greater risk of death (HR: 1.27, 95% CI: 1.21, 1.30). KRAS mutations were only associated with increased risk of death among left-sided colon cancer cases (HR: 1.19; 95% CI: 1.05, 1.34).**Conclusion:** This is the largest population-based study to demonstrate: (1) blacks are at greater risk of right-sided colon cancer compared to other races, (2) right-sided colon cancer is associated with greater risk of death compared to left-sided colon cancer, and (3) KRAS mutations are only associated with risk of death in left-sided colon cancer. Future studies should further explore these associations and determine the role of biology vs. treatment differences. In addition, KRAS testing is increasing, but there is wide geographic variation and may be disparities related to insurance coverage and rurality.**5A2****IMPACT OF AREA-POVERTY RATE ON LATE-STAGE COLORECTAL CANCER INCIDENCE IN INDIANA, 2010-2014**A Cocke¹, **A Raftery**², T McFarlane¹¹Indiana University-Purdue University, Indianapolis, IN, United States; ²Indiana State Department of Health, Indianapolis, IN, United States**Background:** Colorectal cancer (CRC) is the third most common cancer in the United States. Age-adjusted incidence rates from the National Cancer Institute (2009-2013) show CRC has a higher rate in Indiana compared to the national rate (44.0 vs. 40.6 per 100,000 respectively). The Indiana State Department of Health (ISDH) is participating in the National Colorectal Screening Roundtable's (NCCRT) effort to raise the nation's colon cancer screening rate to 80 percent by 2018. Reaching this goal requires interventions in populations not receiving recommended screenings. To identify them, hypotheses to test several measures of socioeconomic status (SES) as predictors of late-stage CRC incidence were undertaken.**Methods:** CRC data from the Indiana State Cancer Registry (2010-2014) included demographic variables and census tracts of cases. Assignment of cases to categories of drive time to hospital, levels of percent poverty, and uninsured status by census tract took place using ArcGIS 10.4 and data from the American Community Survey. For individuals aged 50 years and older, multiple logistic regression was employed to model the association between demographics and census tracts and the outcome of late-stage CRC.**Results:** Census tract poverty level was found to be a significant predictor of late-stage CRC incidence ($p=.009$). Census tracts having <10% poverty (OR=.95, CI=.91-.99) and 10%-20% poverty (OR=.96, CI=.92-.99) were less likely to be associated with late-stage incidence than those having >30% poverty. Demographic variables were also significant predictors of late-stage diagnosis.**Conclusions:** Census tract poverty level should be considered for the future study of CRC incidence and measures of SES. Participants of NCCRT's efforts might consider areas of higher area-poverty rate for targeted screening interventions. The ISDH can identify similar areas within Indiana that may benefit from additional screening support or have barriers preventing screening access.

5A3

DISPARATE BURDEN OF COLORECTAL CANCER IN NEW JERSEY WOMEN BY REGION AND AGE GROUP

AB Crosbie¹, RE Opiekun², LM Roche¹, KS Pawlish¹, LE Paddock^{3,4}, AM Stroup^{3,4}

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Background: Recent studies suggest colorectal cancer (CRC) incidence rates are increasing in younger adults (ages 20-49 years).¹

Purpose: New Jersey State Cancer Registry (NJSCR) data were analyzed to discern any regional variations across the state in incidence rates for younger women with CRC, compared to women of screening age.

Methods: Women were categorized as being above (50 years and older) or below (20-49 years) the current recommended CRC screening age. Comparisons were made between the past two decades (1994-2003 and 2004-2013), by six American Cancer Society (ACS) 2011 service regions for NJ. SEER*Stat was used to generate incidence rates, rate ratios, and 95% confidence intervals around the rate ratios. Basic descriptive measures and chi-square analyses by age group and regions were computed using SAS. Statistical significance was defined as $p < 0.05$. ArcGIS was used to map percent changes in incidence by ACS regions between the two-time periods in the two age groups.

Results: Younger adult women residing in Central NJ, the NJ Shore, and Southern NJ during 2004 to 2013 had 1.4 (95% CI: 1.1-1.6), 1.2 (95% CI: 1.0-1.4), and 1.3 (95% CI: 1.2-1.5) times the rate of CRC incidence compared to the earlier decade. Older women in all ACS regions experienced a significant decline in CRC incidence rates, and drive the overall decline in CRC for women in the state. Additionally, younger women were significantly more likely to be diagnosed at late stage (regional and distant) than women 50 years and older.

Conclusions: The preliminary analyses indicate that CRC is rising in NJ women under the age of 50, and that disparities by region and stage at diagnosis exist. Further analyses are needed with potential use in guiding clinical practice, targeted prevention and screening activities.

Reference: Bailey CE, Hu C-Y, You YN, et al. (2015). Increasing Disparities in Age-Related Incidence of Colon and Rectal Cancer in the United States, 1975-2010. *JAMA*, 150(1), 17-22.

5A4

Withdrawn

CONVERGENT SOCIOECONOMIC DISPARITIES IN CAUSE-SPECIFIC MORTALITY FOR COLORECTAL CANCER PATIENTS, SEER 1998-2013

D Holt¹, S Negoita², M Dunn¹

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B Natural Language Processing and Biomarker Linkage

1:30pm - 3:00pm

5B1

DE-IDENTIFICATION OF UNSTRUCTURED CLINICAL TEXT DOCUMENTS**V Petkov**¹¹National Cancer Institute, Rockville, MD, United States

Background: Cancer registries collect numerous electronic clinical documents to support case abstraction. A huge amount of information beyond the abstracted data is available in the medical records that is of interest to researchers. One obstacle of sharing text records is the personal identifiable information (PII). Successful automated de-identification of clinical text documents would enable use and sharing for advancement of cancer surveillance and research. For example, CDC and FDA are currently working on creation of a Natural Language Processing workbench, which will allow for de-identified reports to be processed for automated data abstraction. SEER Virtual Tissue Repository Program will allow for case selection based on SEER abstracts and de-identified pathology reports for case selection.

Methods: Literature search about de-identification tools/methods was conducted and data were summarized. SEER testing of DE-ID and NLM scrubber included five registries. Each registry randomly selected 800 pathology reports stratified by cancer site. The reports were de-identified and the output was compared to the original reports. The number of occurrences of missed PII by category (such as name, SSN, etc.) were captured and de-identification rates were calculated as N missed/total N of PII by PII category.

Results: A variety of tools exist to support de-identification (NLM scrubber, BoB, MIST, DE-ID, PARAT) as open source, free or commercially available. Their performance is comparable. Studies consistently showed that automated de-identification is comparable to manual de-identification. The results of the SEER study showed very good performance for the PII in the 18 HIPAA categories but was suboptimal for institution names and specimen/pathology report numbers. Some inconsistencies and variability were noted across the registries.

Conclusions: A number of tools are available for de-identification of text documents. However, the majority of the tools may need customization to support optimal performance.

5B2

IDENTIFY CANCER MISDIAGNOSES FASTER BY UTILIZING IBM WATSON EXPLORER, A NATURAL LANGUAGE PROCESSING TOOL**H Kundeti**¹, D Rodriguez¹, M Induni¹¹Cancer Registry of Greater California, Sacramento, CA, United States

Background: Misdiagnosis or late diagnosis of certain cancers like non-muscle-invasive bladder cancers when adequate muscle sampling is not done at the time of resection, could lead to increased mortality among patients according to a research study conducted by Chamie et al. Presently, it takes too long to identify misdiagnoses as the analysis is manual or at best semi-automated making it labor intensive. It has been estimated that 200-250 lives could be saved in California every year depending on if the identification of misdiagnosis in bladder cancers is instantaneous. The system could then send alerts communicating the issue to the attending physician, surgeon, and pathologist. In the recent years, with the advent of machine learning and artificial intelligence, natural language processing technologies, particularly the IBM Watson Explorer, has come of age and can be trained to analyze and interpret all the data, including unstructured text and images.

Purpose: Instantaneously identify misdiagnosed non-muscle-invasive bladder cancer utilizing Watson Explorer Advanced Edition (WEX AE) and relay the misdiagnosis to an alert system

Methods: IBM Watson Explorer Advanced Edition (NLP engine) version 11.0.1 was used to crawl all of the pathology reports data at the California Cancer Registry and the annotators of the rules engine were tuned after appropriate guidance from a cancer researcher. It was followed by configuration of data collection, parsing, and indexing with Watson's Text Analysis Engine.

Results: Although still in progress, preliminary tuning of the annotators of IBM Watson appears to show instantaneous identification of invasive versus non-invasive bladder cancer cases from pathology reports, and the muscle sampling information, with high accuracy. The Cancer Registry of Greater California will focus on tuning the annotators to identify if adequate muscle sampling is performed during endoscopic resection and if an alert is to be generated.

5B3

AUTOMATED CODING OF KEY CASE IDENTIFIERS FROM TEXT-BASED ELECTRONIC PATHOLOGY REPORTS

G Cernile¹

¹Artificial Intelligence in Medicine, Inc., Toronto, Ontario, Canada

While the volume of electronic pathology reports available to cancer registries is increasing at a phenomenal pace, the utility of text-based e-path reports remains limited until reviewed and coded by cancer registrars. Automated coding of key case identifiers such as site, histology, behavior, grade and laterality could immediately enhance the utility of e-path reports for rapid case ascertainment, case finding and earlier estimates of cancer incidence rates.

Results from a 2009 study with Kentucky Cancer Registry (KCR) and Artificial Intelligence In Medicine, Inc. (AIM) to evaluate the use of AI technology for the purpose of automated coding of these key case identifiers show that when the automated system only looks at morphology and topography, the resultant accuracy is not sufficient for real-world use. The technology has now evolved so that many more data elements are available. The automated system uses natural language processing to extract a variety of data elements which are then passed to "coding rules" to derive the case-identifiers.

To create the coding rules, two methods are used. Firstly, hand-coded rules are derived from the SEER coding manuals and run against a large reference set of manually coded reports. These rules show a high-level of performance when the classification data are clearly specified in the pathology report. In cases where the data are not very clear, we explore a second method that uses machine learning to automatically infer the coding rules from the real-time coding data.

In this presentation, we compare the results of the machine learning rules and the manually coded rules against human coders, and show how these techniques may be used in a cancer registry to reduce the manual coding burden.

5B4

LINKAGE OF CANCER REGISTRY DATA TO TISSUE SPECIMENS TO STUDY TUMOR PATHOLOGY AND BRCA1 MUTATION STATUS

AS Hamilton¹, S Ramus², W Cozen¹, E Provenzano³, G Dite⁴, D Hawes⁵, M Southey⁴, J Hopper⁴

¹Keck School of Medicine, University of Southern California, Los Angeles, CA, United States; ²School of Women's and Children's Health at The University of New South Wales, Sydney, Australia; ³Addenbrookes Hospital, Cambridge, Great Britain; ⁴Melbourne School of Population and Global Health, The University of Melbourne, Melbourne, Victoria, Australia; ⁵Childrens Hospital Los Angeles, Los Angeles, CA, United States

Background: Recommendation for genetic testing for *BRCA1* is based on models using age at dx and family history of breast/ovarian cancer. However, these models are imprecise, may not apply to all racial/ethnic groups, and family history information may be lacking. An alternative may be to use tumor pathology to predict the likelihood of having a *BRCA1* mutation as shown by a previous Australian study.¹

Purpose: We sought to validate the previous study in a different population that includes Hispanics.

Methods: Archived tissue blocks from women diagnosed with invasive breast cancer in Los Angeles over the past 10 years were obtained from the Los Angeles Residual Tumor Repository based on registry variables of age at dx, race/ethnicity, and ER/PR status. Pathologists (E.P. and D.H.) recorded 9 tumor morphological features for these cases and corresponding *BRCA1* mutation status was determined using ion torrent sequencing (S.R.). We obtained complete data on 100 cases. We calculated adjusted odds ratios (OR) for likelihood of *BRCA1* mutation based on tumor morphology and determined the ROC statistic to predict *BRCA1* mutation status based on a combination of morphologic features.

Results: We found 9 *BRCA1* positive cases. Our OR for increasing likelihood of a *BRCA1* mutation with each additional morphologic feature was 1.81 compared to 1.80 in the Australian study. Our ROC statistic was 0.82 (0.72-0.93) compared to 0.88 (0.85-0.91) in the Australian study.

Conclusions: The results strongly support the previous findings in this different population. This may help women: (1) who do not know their family history and wish to be tested, and (2) who have already been tested but received a negative result. This study demonstrates how cancer registry data can be used to identify cases for pathological studies.

¹Southey, M., et al., Morphological predictors of *BRCA1* germline mutations in young women with breast cancer. *British Journal of Cancer*, 2011. 104: p. 903-909.

B Natural Language Processing and Biomarker Linkage

1:30pm - 3:00pm

5B5

**THE GEORGIA CALIFORNIA GENELINK STUDY INITIATIVE:
STRATEGY, METHODS, AND OUTCOMES****S Katz**¹, K Ward², D Deapen³, A Kurian⁴, V Petkov⁵

¹University of Michigan, Ann Arbor, MI, United States; ²Emory University, Atlanta, GA, United States; ³Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States; ⁴Stanford University, School of Medicine, Stanford, CA, United States; ⁵Surveillance Research Program, National Cancer Institute, Rockville, MD, United States

Background: Genetic testing after a diagnosis of cancer is growing rapidly. Yet, there are substantial barriers to incorporating these test results into routine reporting in the SEER program. We performed the GACA GeneLink study to determine the feasibility and impact of linking genetic test information to patients newly diagnosed with breast and ovarian cancer and reported to the SEER registries of Georgia and California.

Methods: We linked all genetic tests to all patients diagnosed with breast and ovarian cancer in the years 2013-15 in Georgia and California (n=120,000) in partnership with academic investigators, SEER cancer registries of these states, and the genetic testing companies that comprise nearly all of the market. Files containing personally identifiable information were provided by the SEER registries and test companies to IMS, Inc. Records were matched using an innovative two-step linkage approach that incorporated both probabilistic and deterministic methods. Cancer data and genetic test results for all patients in the cohort were combined into a single file. A statistically de-identified analytic dataset was created based on this master file and provided to the research team.

Results: Breast and ovarian cancer comprised 93% and 7% of cases, respectively. One quarter (24%) of cases matched to one or more tests. The final analytic file will be completed by April 2017. Results will be presented based on descriptive and multivariable analyses that will examine trends and correlates of genetic testing and the distribution of genetic test results by key patient demographic and clinical characteristics.

Conclusion: This highly successful collaboration exemplifies a cost-effective, feasible approach to incorporating precision test information into the registry dataset. We will use the experiences and results of the demonstration project to develop a proposal to incorporate genetic testing into routine reporting process in the SEER program.

5C1

PRECISION CANCER SURVEILLANCE: WHAT CAN WE LEARN FROM NOVEL DATA LINKAGES WITH SEER?

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Background: The Surveillance, Epidemiology, and End Results (SEER) Program (housed in the Surveillance Research Program at the National Cancer Institute) has collected data from cancer registries on cancer incidence, prevalence, survival, and associated health statistics since 1973. The emergence of new treatment modalities and increasing variety of heterogeneous data sources in the era of big data is changing the landscape of cancer surveillance. The SEER Program is evaluating longitudinal data sources that can provide valuable insights across the cancer care continuum. With the goal of enhancing SEER as a robust, collaborative data resource, focusing on the area of cancer treatment data offers both insights and complexities.

Purpose: To describe approaches to obtaining novel data, including an overview of source and types of available clinical data, methodological issues associated with linkages, the relationship to currently reported NAACCR data elements, and the value of these enhancements to SEER registries.

Methods: The comprehensive evaluation of various types of healthcare data (claims, pharmacy, electronic health record, genomic, laboratory, radiology, radiation oncology) offers an opportunity to assess gaps in current cancer surveillance methods and explore feasibility of providing supplemental data elements to registries. Elements provided from each data type, pilot data, missingness, clinical relevance, and reporting requirements were evaluated.

Results: The potential to provide an understanding of cancer patient trajectories from diagnosis to survival outcomes is contingent upon access to high quality health data. An overview of the feasibility, strengths, and limitations of novel linkages with SEER data along with example data models will be provided.

Conclusion: Well-constructed data linkages can harness the capability of key elements to inform an array of detailed clinical and research questions related to establishing a cancer patient trajectory.

5C2

GETTING THE DATA IS ONLY HALF THE BATTLE: OBSTACLES TO DATA SHARING WITH LINKED REGISTRY DATA

E Miller¹, P Pinsky¹, K Keating², S Mathew², T Riley³, J Mabie³

¹National Cancer Institute, Rockville, MD, United States; ²Westat, Rockville, MD, United States; ³Information Management Services, Inc., Rockville, MD, United States

For large national studies linking with multiple cancer registries, the administrative obstacles are considerable. Projects such as the Virtual Pooled Registry may lessen the administrative burden associated with accessing registry data for linkage but issues can still remain after the data are linked. The NCI's Cancer Data Access System (CDAS) houses data from the Prostate, Lung, Colorectal, Ovarian (PLCO) Screening Trial and National Lung Screening Trial (NLST) as resources for cancer researchers. Researchers must apply to CDAS and sign data transfer agreements (DTA) to gain access to the data. Reviews of proposals are limited and researchers can publish under DTA guidelines without oversight. The PLCO and NLST have recently moved from active data collection to passive follow-up with registry linkages, making issues of data ownership and data sharing more complex.

PLCO/NLST data linkages are coordinated by Westat, who has access to the identifiable study data. Linked data are de-identified and securely transferred to Information Management Services, Inc., which produces research data files and acts as data steward. NCI has agreements with multiple registries to conduct linkages and share de-identified datasets with researchers but has encountered obstacles and ambiguous terms in data use agreements that vary substantially across states.

The purpose of this study is to describe the protections in place for CDAS data and variations in state requirements that need to be addressed in order to include registry data in CDAS. We will also examine the various considerations balancing access, privacy and security when making linked data available for research

Switching to passive follow-up has increased the administrative obstacles providing researchers access to registry-linked data. As registries move toward simplifying the process for accessing registry data for linkages, leaders need to consider issues related to data sharing after the data have been linked.

C Linkage Methods and Issues

1:30pm - 3:00pm

5C3

PROBABILISTIC RECORD LINKAGE AT THE FLORIDA CANCER DATA SYSTEM: A DATA SCIENCE PROJECT USING R AND STATA
A Alexandersson¹¹Florida Cancer Data System, Miami, FL, United States

The presentation will discuss probabilistic record linkage at the Florida Cancer Data System (FCDS). Probabilistic record linkage is also known as fuzzy-matching and Fellegi-Sunter record linkage. Applications are many and varied. The three main steps are preprocessing, the actual linking, and a clerical review of uncertain links. The problem is that probabilistic record linkage is difficult to do reproducibly.

FCDS is Florida's statewide cancer registry. FCDS used to use the software AutoMatch for probabilistic record linkage. In early 2016, FCDS investigated alternatives to AutoMatch because AutoMatch is increasingly outdated and it is no longer maintained. The main guiding principles for the software evaluation were reproducibility, cost, and ease of use. Reproducible research refers to analyses published with both source data and code so that others can easily verify the findings and build upon them. FCDS considered many different software for probabilistic record linkage, both specialized software such as Link Plus and BigMatch and general-purpose software such as SAS and Python. FCDS decided to try a combination of R and Stata. R is used for the actual linking, and Stata is used for programming the workflow of data analysis. A programmed workflow of data analysis is also known as data science.

The early experiences of FCDS illustrate that this data science approach of using R and Stata for probabilistic record linkage is useful. The audience will be provided with a literate programming demonstration of probabilistic record linkage using R and Stata. The main programs used are the R package RecordLinkage and the user-written Stata program clrevmatch. Related concepts and tools (such as string matching, seamless code between R and Stata, and automated reporting) will be discussed but in less detail.

5C4

THE DISEASE INDEX COMPARISON SUPERCHARGED: MORE COMPLEX MATCHING AND LINKAGES**W Ross¹, D Ng¹, K Stern²**¹Westat, Inc., Rockville, MD, United States; ²Department of Health and Mental Hygiene, Baltimore, MD, USA

Background: To achieve the highest NAACCR certification for complete, accurate, and timely data, cancer registries must obtain a 95% or higher completeness for case ascertainment and have fewer than 3% of cancer cases sourced from death certificates only (DCO). To ensure this goal was achieved, the Maryland Cancer Registry (MCR) incorporated use of the disease index (DI) to improve registry data completeness and reduce the DCO burden.

Purpose: This study is a continuation and aims to assess the improvements and additions to the DI comparison process and efficacy of using the hospital DIs to improve and guide the death follow back process.

Methods: MCR requested DIs from 2012-2015 from all Maryland (MD) reporting hospitals and matched cancer cases to the MCR database and to MD residents who died during this time by using SAS programming and manual review. Completeness reports were produced from these efforts and sent to hospitals. Registrars from reporting hospitals were then asked to reconcile all non-matched patients existing on their DI for cancer admissions and final dispositions were applied at the central registry. The DI reconciliations were later linked to the death clearance cases.

Results/Conclusion: This presentation will look deeper into the process and complexities involved in DI comparison and death clearance linkage as we receive more data and reach our best DCO rate ever. We will discuss improvements and additions made to the process and linkages to create more robust matching and outputs. Forty-five hospitals submitted 2014 and 2015 DIs. The match rate among DIs submitted ranged from 59% and 97%. The false non-match rate was 3% or less of the total DI observations, due to quality of medical record information used in matching algorithms, among other issues. As we continue to use annual DIs to inform the MCR death clearance follow back and reduce the DCO burden, the DI comparison process becomes more complex, yet the impact is greater.

5D1

A STANDARD PROCEDURE FOR USING CANCER REGISTRY DATA TO INVESTIGATE CANCER CLUSTERS

L Hounsomes¹, A Gavin², D Huws³, D Brewster⁴, K Clough-Gorr⁵, J Rashbass¹, C White³

¹Public Health England, London, Great Britain; ²Nothorn Ireland Cancer Registry, Belfast, Great Britain; ³Welsh Cancer Intelligence and Surveillance Unit, Cardiff, Great Britain; ⁴Scottish Cancer Registry, Edinburgh, Great Britain; ⁵National Cancer Registry Ireland, Cork, Ireland

Background: The organizations which collect and analyze cancer registration data in the U.K. and Ireland are members of the United Kingdom and Ireland Association of Cancer Registries (UKIACR). These organizations often receive requests about the incidence of cancer in small areas, frequently referred to as cancer 'clusters.' These can cause considerable concern for the public and other stakeholders, and often take considerable time to investigate and report on. The response needs to be carefully considered or any analysis may need to be repeated, or worse there may be accusations of 'manipulation' of the data.

Method: The UKIACR analysis group, which has representatives from all five countries, gathered information on current practice for using registry data from members. The literature was consulted for guidance on approaches, including: data sources, involvement of other public health professionals, and communication with the general public. Approaches from organizations such as the Centers for Disease Control (CDC) were assessed.

Results: The guidance is published in full at: <http://www.ukiacr.org/publication/investigating-and-analysing-small-area-cancer-clusters>. Key points are:

- To involve the local lead for public health
- Guidance on statistical methods
- Geographical area considerations
- Reporting any results in an easy-to-understand way, including maps and pre-written text to be used
- A flowchart for registry staff to follow

Conclusions: The publication of a procedure to handle these requests has helped cancer registry staff to be more confident and consistent in their approaches. Supplied text on statistical approaches and data collection should mean messages are more easily understood by the general public. This protocol is supported by a public factsheet on cancer clusters, and is freely available for other registries to use.

5D2

INVESTIGATING A PROSTATE CANCER "EPIDEMIC"

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Background: The method the New York State Cancer Registry (NYSCR) employs to display cancer incidence rates allows the viewer to identify outliers at a glance. These graphical displays are particularly useful to county health departments. Recently the NYSCR was contacted by a county health planner asking for assistance in explaining why their prostate cancer incidence rate for 2009-2013 was 77% higher than the state rate and significantly higher than the rates for all other counties. The planner referred to some physicians "treating prostate cancer aggressively."

Methods: The NYSCR evaluated prostate cancer reporting sources; examined trends in incidence, late stage incidence (regional and distant), and mortality for the state and for the county in question; and conducted a spatial analysis of the prostate cancer distribution within the county. These analyses will be updated to include data through 2014 and expanded to examine treatment patterns.

Results: Only 2.7% of prostate cancer cases statewide are solely reported by a physician practice; whereas the corresponding percentage for this county is 9.0%. Prostate cancer incidence rates in this county have been substantially higher than the state rate since 1976. While rates of prostate cancer in the state have been decreasing since 2007, rates in this county continued to increase through 2011. Trends in late stage incidence showed no consistent significant differences. Similarly, trends in prostate cancer mortality did not differ. The spatial analysis indicated that the prostate cancer excess was confined to one part of the county. The male cancer rate for all sites combined, excluding prostate cancer, did not differ from the rate for the state.

Conclusions: Our analyses confirmed that the high prostate cancer rate in the county is being driven by urology practices that are promoting PSA screening. Local screening patterns can have a substantial effect on county rates.

D Small Area Analysis

1:30pm - 3:00pm

5D3

CHARACTERISTICS OF PHILADELPHIA CENSUS TRACTS WITH HIGH PROSTATE CANCER RISK**C Zeigler-Johnson**¹, R McIntire¹, S Keith¹, A Leader¹, K Glanz²¹Thomas Jefferson University, Philadelphia, PA, United States;²University of Pennsylvania, Philadelphia, PA, United States

Background: Prostate cancer (PCa) risk varies by census tracts (CT). Using age-standardized incidence (SIR) and mortality rates (SMR), PCa disparities can be studied by focusing on CT with higher than expected rates of PCa. The goal of this study is to determine factors associated with living in high SIR and SMR CT.

Methods: We geocoded Pennsylvania Cancer Registry PCa data for Philadelphia, PA (2005-2014) to compute SIR and SMR for each census tract. Three PCa risk groups were created: low (SIR and SMR<1), intermediate (SIR or SMR≥1, not both), and high (SIR and SMR≥1). Logistic regression models examining low vs. intermediate and low vs. high risk (including patient age, race, tumor aggressiveness, PSA, and CT median income) were used to examine associations with higher risk areas.

Results: Models including CT median income showed that high PCa risk CT were associated with increased proportions of older patients (OR=1.32, 95% CI=1.01-1.73) and Black (OR=16.25, 95% CI=13.14-20.10), Hispanic (OR=4.41, 95% CI=3.29-5.92) or other non-white patients (OR=2.31, 95% CI=1.74-3.07). There was a protective association of higher CT median income (2nd quartile OR=0.43, 95% CI=0.34-0.55; 3rd quartile OR=0.20, 95% CI=0.16-0.26; 4th quartile OR=0.17, 95% CI=0.13-0.23). Except for age and 2nd quartile median income, similar associations were found comparing low to intermediate PCa risk CT.

Conclusions: Although we detected no independent associations between high PCa risk areas by clinical factors, we observed associations by patient-level age and race and indicators of CT median income. These characteristics can be used to target communities for interventions to decrease PCa risk where SIR or SMR estimates are unreliable or unavailable at the census tract level.

5D4

AN APPROACH USING CANCER REGISTRY DATA TO ADDRESS CANCER BURDEN IN AN NCI CANCER CENTER CATCHMENT AREA**M McKinley**¹, A Canchola¹, RA Hiatt², C Tai², S Lin Gomez¹¹Cancer Prevention Institute of California, Fremont, CA, United States;²University of California San Francisco Helen Diller Family Comprehensive Cancer Center, San Francisco, CA, United States

Background: The NCI expanded research efforts aimed at defining and describing cancer burden within cancer center catchment areas. Population-based cancer registry data can be a useful resource for these efforts.

Purpose: The Greater Bay Area Cancer Registry (GBACR) worked with UCSF Helen Diller Family Comprehensive Cancer Center to provide a detailed understanding of the cancer burden for specific populations within the City and County of San Francisco (SF) defined by neighborhood and race/ethnicity. Sub-county-level data are used to help guide targeted research and outreach efforts.

Methods: We researched meaningful ways to aggregate census tracts for computing incidence rates. Rates by sex and race/ethnicity were calculated for invasive breast, prostate, lung, colorectal, liver, and melanoma, diagnosed 2008-2012 in San Francisco. We evaluated two geographic aggregations: Medical Service Study Areas (MSSA) and aggregating proximate census tracts based on attribute similarity (i.e., SES and ethnic enclave). 5-year age-adjusted cumulative incidence rates (IR) and 95% confidence intervals (CI) were calculated.

Results: IRs varied significantly across MSSAs. For female lung cancer, the highest rate was in the Bayview/Candlestick/Hunters Point MSSA (IR=49.4, 95% CI: 40.3-58.5), but ranged from 79.9 (95% CI: 56.3-103.5) in blacks to 16.3 (95% CI: 1.9-30.7) in Hispanics. For male liver cancer, the highest rate was in the Chinatown/Civic Center/Inner Mission/North Beach MSSA (IR=38.9, 95% CI: 32.7-45.1), but ranged from 63.8 (95% CI: 27.7-99.8) in Hispanics to 33.2 (95% CI: 24.3-44.2) in whites. IRs by aggregated census tracts based on attribute similarities will also be presented and the two methods will be compared.

Conclusions: Cancer registry data used for calculating local area rates can be a valuable resource for identifying characteristics of the cancer burden, including disparities, within geographically defined cancer center catchment areas.

5E1

RISK OF SECOND CANCER AFTER BREAST CANCER TREATMENT

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Breast cancer is the most common malignancy in Canadian women. During the last decade, breast cancer survival has increased considerably, largely as a result of improved screening and advances in treatment. As the risk of developing cancer increases with age, longer lifetimes are associated with increased probabilities of a second cancer occurrence. A population-based cohort of Ontario women diagnosed with invasive breast cancer in Ontario in 2010 will be identified through the Ontario Cancer Registry to compare the incidence of lung, uterine and ovarian, and acute myeloid leukemia cancer in breast cancer patients with the rates in the general population of Ontario females. The risk of secondary non-breast cancers (SNBCs) or contralateral breast cancers (CBCs) will be quantified using various measures. The standardized incidence ratio (SIR) will compare the observed and expected number of cases of SNBCs and CBCs based on the age-specific cancer incidence rates for Ontario women. Time at risk starts at the breast cancer diagnosis and ends at the date of SNBC/CBC diagnosis, the date of death, or the end of the follow-up. SIR will be computed for 4 age groups at diagnosis: 30 to 39, 40 to 49, 50 to 69, and 70 to 74 years.

5E2

BREAST CANCER BIOMARKER DATA QUALITY EVALUATION AMONG CENTRAL CANCER REGISTRIES IN THE US, 2010-2013

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Background: Breast cancer biomarkers such as estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factors receptor 2 (HER2) are important factors used for molecular subtype classification, staging, and treatment. All Central Cancer Registries (CCRs) in the United States (U.S.) are required to collect ER and PR in 2004 and Her2 in 2010. As relatively new variables, the data quality of these biomarkers needs to be periodically evaluated.

Objective: This study evaluated completeness of ER, PR, and HER2 data for invasive female breast cancer from 48 CCRs in the U.S.

Methods: Data for women with primary invasive breast cancer diagnosed between 2010 and 2013 were obtained from the 2016 CiNA Analytic File. Collaborative Stage System Site Specific Factors (SSFs) 1, 2, and 15 for breast cancer, which represent ER, PR and HER2 summary testing results respectively, were examined by individual code value. Summary statistics on unknown/missing values by demographic and geographic variables for each biomarker were tabulated.

Results: Overall unknown/missing percentages ranged from 4.7% to 7.1% for ER, 4.7% to 7.4% for PR, and 9.1% to 29.4% for HER2 over the 4-year period. Although completeness for each biomarker gradually improved over time among all the CCRs, large variations still exist. Five CCRs indicated a higher percentage of unknown/missing values for all three biomarkers and have consistently been outliers among 48 CCRs. The code value of 988 (not applicable) for HER2 was also largely misused in two states in 2010. In addition, patients aged 75 years and older or reported by other facilities rather than hospital settings or radiation treatment/medical oncology centers had a much higher unknown/missing percentage for these biomarkers.

Conclusions: The overall completeness of the three biomarkers was high from 2010 to 2013 except Her2 in 2010. Constant monitoring and improvement on these biomarker collections are warranted to ensure accurate interpretation.

E Breast Cancer

1:30pm - 3:00pm

5E3

PATTERNS AND RECENT TRENDS IN MASTECTOMY AND BREAST CONSERVING SURGERY FOR WOMEN WITH EARLY-STAGE BREAST TUMORS IN MISSOURI**C Schmaltz**^{1,2}, J Jackson-Thompson^{1,2,3}, J Du^{1,4}, B Francis^{1,2}¹Missouri Cancer Registry and Research Center, Columbia, MO, United States; ²Department of Health Management and Informatics (HMI), School of Medicine, University of Missouri-Columbia, Columbia, MO, United States; ³MU Informatics Institute, University of Missouri-Columbia, Columbia, MO, United States; ⁴Department of Statistics, College of Arts and Sciences, University of Missouri-Columbia, Columbia, MO, United States

Background: Most women age 18–64 diagnosed with an early-stage breast tumor in Missouri, 2008–2014, were surgically treated with either total (simple) mastectomy (TM), modified radical mastectomy (MRM), or breast conserving surgery (BCS). BCS is less invasive than TM and MRM and may be a reasonable treatment for some women with early-stage tumors; however, the percentage of cases receiving BCS had decreasing over 2008–2014 along with an increase in TM.

Purpose: To examine recent trends in the surgical treatment of early-stage breast cancer in Missouri and describe the patterns by sociodemographics and tumor characteristics.

Method: The “BCS” measure from the NCDB CP3R was adapted to central cancer registry data along with corresponding measures for mastectomy. Logistic regression was used to analyze the trends in BCS, TM, MRM, & combined TM+MRM over the years 2008–2014 among white and black women age 18–64 with early-stage breast tumors (AJCC stage 0, I, or II) while controlling for age (in 9 groups of mostly 5-year spans), race (white & black only), geographical region, primary payer, and stage.

Results: The percentage of cases receiving BCS had decreased even after controlling for the selected demographics and tumor characteristics. The percentage receiving TM had increased. The percentage receiving MRM had gone down, but when added with TM, the combined percentage receiving mastectomy (TM+MRM) had increased (the remainder being primarily the decreasing percentage of BCS). Whites had a lower percentage of BCS than blacks, and higher percentages for both TM and MRM. Younger women were less likely to receive BCS and more likely to receive TM; age-trends for MRM were weak.

Conclusions: These data provide quantitative population-based data on the surgical treatment for women diagnosed with early-stage breast tumors in Missouri. Trends and sociodemographic patterns may help inform patients and health professionals in Missouri by providing broad information on treatment options being utilized.

5E4

PATTERNS AND FACTORS ASSOCIATED WITH INITIAL TREATMENT OF DUCTAL CARCINOMA IN SITU BREAST CANCER IN THE US**M Wu**¹, T Thompson¹, L Amanda¹, R Wilson¹¹Centers for Disease Control and Prevention, Atlanta, GA, United States

Background: Ductal carcinoma *in situ* (DCIS) is considered a precursor to invasive breast cancer, and it is unclear which women will eventually develop invasive cancer. Every year, nearly 50,000 women in the U.S. are diagnosed with DCIS. With DCIS treatment evolving and the many treatment options, considerable debate exists about the optimal treatment. Understanding patterns of care and factors that may influence treatment decisions can help providers and patients make better informed choices.

Purpose: This study examined current initial treatment patterns and demographic, geographic, and tumor factors associated with treatments among DCIS breast cancer women in the U.S.

Methods: We used the NPCR and SEER combined cancer registry data. All women in the U.S. with a primary DCIS breast cancer diagnosed between 2009 and 2013 were included. Initial treatment by modality was examined. Regression analysis on factors such as patient’s age; race/ethnicity; resident region and county; economic status; tumor size, grade, and marker; and history of previous tumor associated with treatment was also performed.

Results: A total of 241,647 DCIS women were included in our study. About 61% underwent breast conserving surgery (BCS). Contralateral prophylactic mastectomy rates continued to rise. Among those who had BCS, 64% also received radiation therapy. Only about 1% had chemotherapy. Among the estrogen receptor and/or progesterone receptor positive patients, about one third received hormone therapy. Treatment patterns were similar across all race/ethnicity groups. However, factors predicating each type of treatment varied.

Conclusions: Treatment for DCIS is complex and varies by demographics, geographic, and tumor characteristics. Outcomes data by treatment modality will help develop evidence-based guidelines.

P-01

USING NATURAL LANGUAGE PROCESSING TO SCREEN AND CLASSIFY PATHOLOGY REPORTS

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The California Cancer Registry (CCR) receives approximately 112,000 pathology reports electronically through an HL-7 message transmission. Traditionally, each of these electronically transmitted reports referred to as narrative path reports have been manually reviewed to determine reportability and then classified.

The CCR entered into a contract agreement with a natural language processing company, Health Language Analytics Global (HLA-G), to reduce the manual work effort. Manual screening and classification takes an average of approximately 2 minutes per report and is often several months behind.

Our pilot project consisted of providing HLA-G with 10,000 representative path reports (5,000 reportable/5,000 non-reportable) that they used to develop an algorithm to determine reportability. They would also classify the following variables in ICD-0-3 format: Site, Histology, Behavior, Grade, Laterality, and Date of Diagnosis. They built a language model from a 'training set' of documents which are annotated manually. The language model was assembled using NLP analysis of text and annotated content was analyzed by a machine-learning algorithm. The goal was for HLA-G to reach a 90% accuracy rate for screening as well as classifying path reports. If that percentage were achieved, our pilot project would be implemented as an ongoing solution to screening and classifying pathology reports.

This poster presentation will outline details on the methods used by CCR to extract representative pathology reports, preliminary results as well as the final results of the pilot project. The poster will also outline conclusions, recommendations and next steps.

P-02

CANCER CASE TRANSMISSION TO CENTRAL CANCER REGISTRY USING WEB SERVICES (C/NEXT AND EUREKA)

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The Cancer Abstract Direct Transmission to Central Registry pilot project focused on developing a web-service that facilitated the direct transmission of cancer abstracts from C/NExT to the California Cancer Registry.

Project outcomes included:

- Interoperability between the California Cancer Registry and C/NExT
- Enabled the ability to reject incoming records that did not pass edits using the current edit metafile while notifying the sending facility
- Enabled the ability to reject exact duplicate admissions, while notifying the sending facility
- Enabled the ability to reject admissions that are not in a supported record layout while notifying the sending facility
- Eliminated the need to have cancer abstracts manually uploaded by registry staff to the registry
- Eliminated the need for regional registry staff to monitor and fix records/files that currently fail in the manual file upload process

The pilot project was successful and approved for production starting July 2017.

This pilot project was a collaboration between the California Department of Public Health, C/NEXT Solutions, CalCARES, Kaiser Permanente, Sutter Health, and Washington Hospital Healthcare System.

P-03

TNM EDITS ARE STAGING GUARDRAILS**D Gress¹**¹American Joint Committee on Cancer, Chicago, IL, United States

Guardrail is defined as a rail that prevents people or cars from falling off or being hit by something. Guardrails protect you. Wouldn't it be great to have guardrails in other areas of your life like friendships and finances to protect and help you?

NAACCR has provided guardrails for AJCC staging in the form of TNM edits. The edits exist to keep you from "going off the cliff" and assigning a stage that doesn't follow the rules.

But don't stage to the edits. If you get an edit, don't start trying every T or N category until you find one that passes the edits. Look at the AJCC rules and determine the accurate stage for the patient's scenario. Then if there is an edit issue, ask someone. Are you applying the AJCC rules accurately? Are you mistakenly using CS rules? Is there an issue with the edit?

TNM edits exist to improve the accuracy of your data. Edits perform the function of a guardrail, keeping you from providing data to physicians, administration, or your state that is inaccurate, or "going off the cliff."

P-04

UTILIZING HOSPITAL CANCER REGISTRY OPERATIONS TO IMPLEMENT STATEWIDE EARLY CASE CAPTURE FOR ALL CANCERS**D Rousseau¹**¹Rhode Island Cancer Registry, Providence, RI, United States

Rhode Island's comprehensive cancer control plan calls for statewide rapid case reporting for all cancer sites. The goal is to provide timely data for surveillance, public health and hospital strategic planning, research, and increasing participation in clinical trials. After being selected to participate in the Early Case Capture of Pediatric and Young Adult Cancers (ECC/PYAC) project, it became obvious that the same methods used to identify and submit pediatric cancer cases could be used to implement rapid case reporting for all cancers within one month of first contact.

Each month, hospital cancer registries create a suspense file by using inpatient discharge lists, outpatient visits, pathology reports, oncology logs, and radiation therapy reports to identify cancer cases. Initially, hospitals were required to identify and report selected pediatric and young adult cancer cases. This proved to be complex and labor intensive. The decision was made to simplify the process and to require hospital cancer registries to submit the monthly suspense file in the NAACCR format. This change provided the RICR with newly diagnosed cancer cases including required ECC cases as well as update information on previously reported cases.

The Commission on Cancer (CoC) developed the Rapid Quality Reporting System (RQRS). The CoC describes RQRS as a reporting and quality improvement tool which provides real clinical time assessment of hospital level adherence to quality of cancer care measures. Starting in January of 2017, RQRS participation is required for all CoC accredited programs.

A pilot project was undertaken that included the submission of the cases entered into the hospital cancer registry suspense file as well as RQRS eligible cases in the NAACCR format. The suspense file provided a source for rapid case reporting and RQRS cases as a source of improved diagnostic, clinical, and treatment data. This process will be expanded to include all cancers.

P-05

FINDING “ZOMBIES” IN YOUR DATABASE BY CONFIRMING VITAL STATUS

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Central cancer registries use several external mortality databases to determine the current vital status of their cancer cases. Current vital status is important for various projects such as survival analysis and cancer research. The external databases include their state mortality database (SMD), Social Security Death Index (SSDI), and National Death Index (NDI). But even after reviewing these databases, there are some cancer cases that are reported to central registries by healthcare providers as being deceased but whose vital status cannot be verified. There are legitimate reasons for why certain deceased cases are not included in SMD, SSDI, or NDI. However, often it is just due to an error in data entry. I refer to these types of cases as “zombies” – deceased cases that are actually alive. Most central cancer registries are not aware that these types of cases exist in their database.

The Alaska Cancer Registry (ACR) did a study to identify its zombie candidates and verify their vital status. After the annual SMD death clearance linkage, ACR identified 85 deceased cases with unverified vital status, representing about 0.2% of its total number of reportable cases for all diagnosis years. An unusually high percentage of the 85 cases, 51.8%, were reported to ACR by other central cancer registries. After SSDI and NDI linkages, 65 cases (76.5%) were verified as being deceased. For the remaining 20 cases, ACR used the Alaska Permanent Fund Applicant Database and the Alaska State Troopers Database to verify vital status. ACR verified that 14 (16.5%) of these cases were still alive (true zombie cases) and changed their vital status in the database. Of the remaining cases, three were out-of-country deaths, one was an out-of-state death that did not get reported to NDI, and two had in-state deaths confirmed in hospital chart notes with no state death certificates. Zombie cases can also cause concerns for other healthcare programs in which vital status is important.

P-06

OKLAHOMA CENTRAL CANCER REGISTRY AUDIT PROCESS FOR EVALUATING DATA QUALITY AND COMPLETENESS

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Background: The Oklahoma Central Cancer Registry (OCCR) is a population-based registry collecting cancer cases diagnosed and/or treated within Oklahoma. Ensuring data completeness and quality is a vital registry operation. High staff turnover and lack of training can result in poor cancer case abstraction and affect data quality. It is also important to assess facilities with decreased case reporting. In 2016, OCCR developed a Data Quality and Completeness (DQC) audit protocol and used results for training recommendations.

Method: A selection criteria determined which facilities would benefit from an onsite DQC audit: (1) new reporters/frequent staff turnover, (2) decreased cancer case reporting, (3) no text documentation, and (4) low score on data quality measures. The selected facility receives a 6-week notice and is requested to provide a list of all patients discharged with ICD-9-CM cancer code for specified time period. OCCR matches the patient list via Link Plus to the OCCR database and based on results, patient records are selected for review. There are two audit components: (1) case finding—review of patient medical charts for reportable status, and (2) quality assurance audit—re-abstraction of cancer cases.

Results: OCCR conducted five 1-day onsite audits. The re-abstraction highlighted areas for improvement. Most quality errors were made by inexperienced reporters. All facilities were found to have reportable cases that were not reported. Given the limited time, not all non-linked cases could be reviewed. A summary outlining the percentage of accuracy of the case-finding practices and the quality of abstracts was provided.

Conclusion: The DQC audit protocol provides a mechanism to routinely monitor data completeness and quality. The onsite visit allows OCCR to maintain working relationships with facilities. Re-abstraction was found to be successful in assessing data quality. OCCR needs to explore alternate methods in reviewing case finding procedures.

P-09

MINIMIZING THE IMPACTS OF ADDRESS-COUNTY UNCERTAINTY TO NORTH CAROLINA CANCER STATISTICS**C Klaus**¹, C Coggins¹¹North Carolina Central Cancer Registry, Raleigh, NC, United States

Minimizing the impacts of uncertainty in the association of Address at Diagnosis and County at Diagnosis on cancer statistics in NAACCR versions 16 and 17 requires taking on many challenges. This is especially true for eastern U.S. states not subdivided under the terms of the U.S. Land Ordinance of 1785, and whose county boundaries are thus not coincident with Public Land Survey System (PLSS) survey lines. Many CCRs are compelled to have incoming address pass the postal code-city-county-state edit, to have a minimal level of confidence in geolocation of cases that do not geocode to street level. At 16/17, County at Diagnosis is still used for the county/tract edit. Furthermore, U.S. hospitals reporting cancer abstracts to central cancer registries rely generally on the USPS ZIP+4 database to determine county of address at diagnosis, a use for the USPS ZIP+4 county data item that USPS never intended to support.

To meet these challenges, we run NPCR (county-tract) edit, and NC (postal code-city-county-state) edits against the North Carolina Master Address Repository of 4.9M addresses, to identify addresses for which USPS and U.S. Census disagree with county data stewards, and each other, as to the association of a given address and county. We minimize the propagation of address-county association error into our data by determining this first, so that we know which address/county associations must be fixed in the cancer case file, and which postal code-city-county-state combinations must be added to the edit file, for all cases to pass the postal code-city-county-state edit.

P-10

CALIBRATING THE NAACCR HISPANIC IDENTIFICATION ALGORITHM (NHIA)**X Zhang**¹, F Boscoe¹¹New York State Cancer Registry, Bureau of Cancer Epidemiology, New York State Department of Health, Albany, NY, United States

Background and Purpose: For over a decade, NAACCR member registries have been using the NAACCR Hispanic Identification Algorithm (NHIA) to enhance the completeness and accuracy of Hispanic ethnicity coding. The algorithm uses country of birth, surname, and county of residence to modify the reported Hispanic ethnicity code. This poster proposes some enhancements to NHIA based on: (1) a slightly different Hispanic identification algorithm employed by the New York State Cancer Registry (NYSCR) that predates NHIA, and (2) replacing the sample-based 1990 Hispanic surname list with a population-based 2010 surname list.

Methods: All invasive malignant cancer cases diagnosed between 2009 and 2013 were obtained from the NYSCR (n=505,601). The NAACCR and New York versions of NHIA, along with the 1990 and 2010 Hispanic surname lists, were applied to all cases and any resulting differences were identified and tabulated. To assess the expected impact on national rates, we used country of birth data from 44 American registries included in the CINA research database, and assumed the population-based 2010 surname list was representative of the national population with cancer.

Results and Discussion: New York can expect an increase in crude cancer rates among Hispanics of about 1%. The nation as a whole can expect a decrease of up to 2%. The main contributor to the decrease are thousands of uncommon surnames previously considered Hispanic based on very small sample sizes which are now considered non-Hispanic based on results from the entire population. Changes resulting from prioritizing birthplace over reported Hispanic subgroup code as has been done in New York (e.g., a person born in Puerto Rico will be coded as Puerto Rican even if reported as Cuban) will have negligible impact nationally, but we nevertheless endorse the idea as it does impact substantial numbers of Dominicans in New York.

Conclusion: The proposed updates to NHIA will yield more accurate Hispanic and Hispanic subgroup coding.

P-11

THE CASE INVESTIGATION OF CERVICAL CANCER (CICC) STUDY: CHART ABSTRACTION FROM PRIMARY AND SPECIALTY CARE PROVIDERS 5 YEARS PRIOR TO PATIENT DIAGNOSIS

A Crawford¹, V Benard¹, **A Greek**², A Stroup⁵, N Herman⁵, M Hsieh³, G Alverson⁴, M O'Flarity³, W Huh⁶, J Jackson²

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Background and Significance: CDC's Case Investigation of Cervical Cancer (CICC) study will evaluate why women continue to get cervical cancer, a largely preventable disease. This part of the study will review medical charts from different health care settings to assess patient's cervical cancer screening, follow-up, and treatment 5 years prior to cancer diagnosis. A second arm of the study (not described here) will assess patient barriers and facilitators to screening and care.

Methods: Beginning in early 2017, three state cancer registries (Louisiana Tumor Registry, Michigan Cancer Surveillance Program, and New Jersey State Cancer Registry) will enroll women with invasive cervical cancer diagnosed between 2014 and 2016. Participants will be consented and asked to provide where they received medical care 5 years prior to diagnosis. This information, along with registry data, will identify relevant providers for the chart review. The medical record abstraction form will include provider type; patient demographics; and history of cervical cancer screening, follow-up care, cervical biopsy, endocervical curettage, histology, surgical pathology, and surgery. Training on data collection and review of practice will be conducted in three phases to ensure consistency across registries and staff throughout the study. Abstraction forms for the medical chart review will not contain any patient identifiers.

Results: Of the 1,670 eligible participants, we estimate that 40% will consent to medical record abstraction. At the time this abstract was submitted, the first phase of the abstraction training sessions has been completed.

Conclusion: Findings from this part of the retrospective study can identify points of care to improve cervical cancer prevention, early diagnosis, and treatment.

P-12

MEANINGFUL USE CANCER REPORTING: HOW MEANINGFUL IS IT? AN ANALYSIS OF DATA SUBMITTED TO THE MARYLAND CANCER REGISTRY

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Background: Meaningful use (MU) supports the use and transfer of electronic health records (EHR) in ambulatory settings for cancer reporting. Valid data relies on EHR users, EHR specifications to create the record in CDA-HL7 format, and processing software that maps it into an abstract. It is important to assess usefulness and validity of reports received through MU.

Purpose: The Maryland Cancer Registry (MCR) aims to evaluate the validity of coded data elements from MU reports, determine the proportion of abstracts matched to the MCR database (already reported) and non-matched (new) cases, and evaluate whether information from MU reports adds to matched cases.

Methods: We conducted a preliminary analysis of selected CDA records. We used information in the CDA record to independently abstract selected data elements and compared this to the coded data from the record that was converted into abstracts by the processing software, eMaRC. We conducted a match of the same MU abstracts to the MCR database. Matched abstracts were compared to evaluate whether any new information was obtained from MU abstracts.

Results: Histology was coded appropriately in 80% of the abstracts. Information in text fields and other areas could be used to update the histology when incorrect. Treatment fields were often coded as "none," despite having treatment information elsewhere in the CDA record and associated abstract. We matched 60% of abstracts to the MCR database; the other 40% were new cases. For matched cases, existing abstracts in the database contained more complete and specific information with little information added.

Conclusions: MU reporting yielded new cases leading to more completeness. When matched, reports added little additional information. Central registries will need to institute quality measures to validate coded data and examine text fields and to promote improved data input. As this was a small sample of records, future analyses are planned to assess the benefits of MU.

P-13

ADDRESSING REPORTING GAPS IN MARYLANDC Groves¹, M Mesnard¹, K Stern²¹Westat, Rockville, MD, United States; ²Maryland Department of Health and Mental Hygiene, Baltimore, MD, United States

Background: The landscape of health care is changing rapidly. Multi-faceted and complex health care systems are emerging that include large acquisitions and mergers. Hospitals may assume responsibility for reporting cancer cases for other sources with whom they have affiliations, such as physician offices. Because hospitals only report cases from affiliated sources who received a clinical service in-network, this leads to gaps in reporting when the service is out of network.

Purpose: The presentation describes process improvement efforts to address methods of reporting for other sources and gaps in reporting when facilities report on behalf of other sources.

Methods: Westat developed guidance for reporting facilities based on Maryland reporting requirements. The procedures outline differing types of systems, define who is responsible for reporting by type of system, and identify methods to document for data collection.

Results: Both the reporting and source facilities have a responsibility for reporting. Facilities that report on behalf of other reporting sources should have a formal (i.e., written) agreement to report regardless of whether the case was service in network or out of network. Facilities reporting for other facilities should also document and distinguish the Registry ID, Reporting Facility, and Type of Reporting Source in each abstract to identify the data source as well as the transmitter.

Conclusions: Based on the type of health care system, including large networked systems, procedures enable the central cancer registry to provide consistent guidance to reporters. Facilities that report on behalf of others should put processes in place to identify cases that might be missed when not seen in network with the goal of complete reporting. Guidance to registries will promote consistent and accurate accounting of reporting. With the appropriate collection of reporting source and reporting facility, central registries can track complete and accurate data.

P-14

CODING SOFTWARE FOR CANCER REGISTRY INDUSTRY AND OCCUPATION: NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH INDUSTRY AND OCCUPATION COMPUTERIZED CODING SYSTEM (NIOCCS)S Nowlin¹, S Silver¹¹National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Cincinnati, OH, United States

Background: Cancer registries usually receive industry and occupation (I&O) information in text format. For this information to be useful for epidemiologic studies, I&O must be transformed into standardized codes.

Purpose/Methods: National Institute for Occupational Safety and Health Industry and Occupation (NIOSH) developed the NIOSH Computerized Coding System (NIOCCS) to code text-format industry and occupation into Census Industry and Occupation codes. Modifications to improve system performance are undertaken on an ongoing basis; recent achievements include development of new user interfaces, improved coding capabilities, and restructuring of the underlying knowledge base.

Results: NIOCCS I&O autocoding rates have improved with software enhancements but continue to vary by data source, reflecting differences in the quality of incoming data. Death certificate I&O autocoding has increased from 61% in 2013 to 84% in early tests of the new system release (2017), and autocoding for I&O from the Behavioral Risk Factor Surveillance System has risen from 42% to 76%. Autocoding success for cancer registries varies by state but tends to be lower than success for other sources because of problems such as: (1) missing I/O, (2) I/O too general to code, (3) use of "retired" in place of I/O, and (4) recording of company names in place of I/O.

Conclusion: NIOCCS enhancements continue to improve validated autocoding rates for the software. However, the goal of having cancer registry I&O autocoding rates mirror those for death certificates will require increased recording and capture of I&O information that is specific enough for coding.

P-15

PRESENCE OF CODABLE INDUSTRY AND OCCUPATION IN CALIFORNIA CANCER REGISTRY DATA: DIFFERENCES BY PATIENT DEMOGRAPHICS, PAYOR, CASEFINDING SOURCE, AND TYPE OF MALIGNANCY

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Background: Cancer registry information about patient industry and occupation (I/O) can be used to assess associations among different types of work and malignancies. However, if I/O data are not consistently available, the validity and precision of findings can be impacted.

Purpose/Methods: To assess differences in codability, I/O text from 257,355 first primary cancers diagnosed 2011-2012 and reported to the California Cancer Registry was coded using the National Institute for Occupational Safety and Health Industry and Occupation Computerized Coding System (NIOCCS) for autocoding and computer-assisted coding. For each case, I/O were either coded to a U.S. Census I/O code (classified as codable) or classified as blank/inadequate, retired, or not working for pay. Percentage of codable cases was calculated by patient demographics, payor, casefinding source, and type of malignancy.

Results: Less than 40% of cases had codable industry. Industry was blank/inadequate for nearly 50%, and 10% had “retired” instead of usual industry. Cases of peak working ages (25-60) were more likely to have codable industry than those younger or of retirement age. Differences by race and sex were ≤6%. Hospital diagnosis/treatment sources were most likely and private pathology laboratories least likely to have codable industry. Cases paid by preferred provider organizations were most and Medicaid-eligible cases least likely to have codable industry. By malignancy, codability ranged from <30% (melanoma, bladder cancer, Kaposi’s sarcoma, and several cancers of the digestive system and of male and female genital organs) to 50-60% (mesothelioma, pleural cancer, tonsil cancer). Most results were similar for occupation.

Conclusion: Researchers should be aware of potential impacts of differences in usable I/O by age, payor, casefinding source, and type of malignancy. Improvements in the availability and quality of I/O data should enhance the utility of cancer registry data for public health research.

P-16

IMPROVING THE ACCURACY OF TYPE OF REPORTING SOURCE DATA FIELD AT THE NEW JERSEY STATE CANCER REGISTRY

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Background: The New Jersey State Cancer Registry (NJSCR) identified an opportunity to improve the correct consolidation of the Type of Reporting Source (TRS) data field in our registry database. This field is used to assess completeness by various reporting sources, monitor changes in reporting trends over time, and plan research studies and is required by federal funding agencies.

Purpose: To improve the accuracy of TRS in the NJSCR database.

Methods: We conducted an analysis of cases coded from non-hospital sources consolidated during a 2-week period in October 2016 and reviewed the cases to assess if TRS was correctly consolidated. In early 2017, we will conduct a training program to educate NJSCR staff on the proper assignment of reporting source codes and send information about correcting coding of TRS to hospital registrars via our electronic newsletter. After these interventions, we will assess accuracy of TRS coding in a random sampling of cases consolidated during February, April, July, and October 2017.

Results: At baseline, 51% of cases consolidated in October 2017 had incorrect TRS assigned. Accuracy varied by type of reporting source, with the percent of cases with incorrect TRS ranging from 20% of cases originally coded as laboratory to 87% originally coded as outpatient/surgery center. We identified differences in staff training, ambiguity of coding rules, and fluidity of health care facility and frequent changes in organizations as factors contributing to the incorrect coding of TRS. Results on accuracy of the TRS in cases consolidated during February 2017 and April 2017 will be presented.

Conclusions: After review of cases sent by a variety of reporting sources, we determined that the TRS data field was coded incorrectly for 20-87% of cases, based on the type of reporting facility. We conclude that a goal of 98% accuracy is a realistic expectation after education of registry staff and hospital registrars.

P-17

EXPLORING A NEW DATASET: PRIMARY CARE PRESCRIPTIONS PRE- AND POST-CANCER DIAGNOSIS IN ENGLANDK Henson¹, B Shand¹, K Hunter¹, V Coupland¹, L Elliss-Brookes¹, R Brock¹¹National Cancer Registration and Analysis Service, Public Health England, London, Great Britain

Background: The National Cancer Registration and Analysis Service in Public Health England (PHE) has partnered with NHS Business Services Authority to receive pseudonymized national record-level data on primary care prescriptions in England. This pilot study analyzed prescriptions for cancer patients in the 3 months prior to, and following, their cancer diagnosis and explored variation by cancer stage at diagnosis.

Methods: Pseudonymization enables prescription data to be securely linked to cancer registration data. The pilot covered prescribing dates during the period April to July 2015; these dates were compared to the cancer diagnosis date to create a peri-diagnosis timeline. All malignancies (excluding non-melanoma skin cancer) diagnosed between January and October 2015 were included; patients without a prescription record were excluded, as were patients whose cancer was unstaged. Stage 1 and 2 cancers were combined into early stage. Drugs were classified according to the hierarchy described in the British National Formulary.

Results: Following linkage there were 165,913 prescription items for 11,254 patients with cancer diagnoses. 58% of these patients had either breast, colon, lung or prostate cancers. Stage was unknown in 2,232 patients. For early stage cancers, the most commonly prescribed medication group was lipid-regulating drugs. This was also true pre-diagnosis for stage 3 and 4 cancers but, in this group, opioid analgesics and enteral nutrition increased substantially from one month prior to diagnosis, particularly amongst stage 4 cancers. For these patients, opioid prescriptions increased from 8% of patients three months prior to diagnosis, to 31% 1 month post-diagnosis.

Discussion: This is the first investigation into primary care prescription patterns amongst cancer patients in England. The most commonly prescribed medications for patients with stage 3 and 4 cancers appear to be associated with the effects of cancer and its treatment.

P-18

UNITED KINGDOM AND IRELAND ASSOCIATION OF CANCER REGISTRIES (UKIACR) PERFORMANCE INDICATORS 2017 REPORT
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Background: All five UK and Ireland cancer registries extract data relating to a number of performance indicators to allow comparisons of the timeliness, quality, and completeness of their data. This information is collated centrally and an annual report is published.

Methods: The measures are broken down by cancer type and some indicators measured are as follows:

- Stability of incidence in the current year compared to the average of the three previous years
- Completeness of data items such as known date of diagnosis, date of birth, identification number, ethnicity, and tumor behavior code
- Completeness of screening category for breast, bowel, and cervical cancers
- Completeness of stage at diagnosis by cancer type and morphology
- Proportion of death certificate only (DCO) cases
- Proportion of patients whose morphology code is non-specific, proportion of microscopically verified cases, the mortality to incidence ratios
- Proportion of tumors that have any treatment where treatment would be expected (i.e., childhood, early stage)

Results: Comparing 2010 data with that for 2014 this comparison has documented:

- An increase in staging from 41.4% to 63.5%
- An increase in completeness of hormone therapy for breast cancer from 29.6% to 39.7%
- An increase in completeness of hormone therapy for prostate cancer from 31.8% to 37.7%
- A decrease in DCO rates from 1.3% to 1.0%
- An increase in microscopic verification rates from 84.6% to 85.7%

Results for 2015 data will be published soon.

Conclusions: The quality and timeliness of data held by cancer registries in the UK and Ireland has been documented over the past few years with areas for action highlighted and data quality improved.

P-19

MEANINGFUL USE REGISTRATION AND REPORTING IN TENNESSEE

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Background: The Electronic Health Record (EHR) Incentive Program, also known as Meaningful Use (MU), was established by the Centers for Medicare and Medicaid Services to encourage eligible professionals to adopt, implement, upgrade, and demonstrate the meaningful use of certified EHR technology for public health purposes. Cancer reporting under MU requires transmission of cancer reports in Health Level 7 (HL7) Clinical Document Architecture (CDA) from a certified EHR.

Purpose: Provide a detailed look at the challenges, lessons learned, and successes of cancer reporting under MU in Tennessee.

Methods: The Trading Partner Registration (TPR) application allows eligible providers to register their intent to exchange data with the Tennessee Cancer Registry (TCR). The TPR application allows public health agencies within the Tennessee Department of Health to track providers through the MU process and generate documentation (i.e., Milestone Achievement Letters), which providers may use for MU attestation. Information about the TPR application is available on the following website: <https://apps.tn.gov/tp/>.

Results: As of January 2017, 793 physicians had registered in the TPR application. The TPR application tracks providers using 4 distinct statuses which include: in-queue (283 providers), testing (243 providers), onboarding (68 providers), and production (0); 199 providers (25%) did not have EHR software certified for cancer reporting. So far, 8 providers have successfully submitted a HL7 CDA file that has passed CDA Validation Plus requirements. However, we have experienced issues with establishing a Direct Secure Messaging connection with these providers due to the capability of their EHR product.

Conclusion: Successful implementation of cancer case reporting for MU requires extensive effort and time by cancer registry staff, supporting IT staff, EHR vendors, and providers.

P-20

CHILDHOOD CANCER DATA COLLECTION: A TREND ANALYSIS OF COMPLETENESS AND DATA QUALITY FROM NPCR-ECC (OCTOBER 2012- OCTOBER 2016 SUBMISSIONS)

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Introduction: Cancer incidence in children is less common than in adults and thus it is problematic to obtain timely, child-specific, meaningful, and large enough incident data to support scientific studies and treatment evaluation research. The Early Case Capture (ECC) of Pediatric and Young Adult Cancers (PYAC) program was created to address this issue. Built on the existing National Program of Cancer Registries – Cancer Surveillance System (NPCR-CSS), the ECC project captures state surveillance data on childhood cancers from the latest available year, sometimes within 30 days of diagnosis for specific sites.

Purpose: This study examines trend in completeness and data quality of childhood cancer incidence data collected from the ECC system, which began submitting data in October 2012.

Methods: The methodology used to calculate pediatric case completeness is based on the NAACCR methodology, but omits the adjustment for background mortality due to the limitation of mortality data. It compensates for small case counts by pooling cases across race, sex, and site and grouping cases into five age groups. Data quality indicators were evaluated by tracking the percentage of invalid or blank values across data submissions.

Results and Conclusion: The changes in case completeness and data quality over time may suggest the overall improvements in data collection among the participating states. Areas for improvement will also be revealed.

P-21

DATA QUALITY ASSESSMENT OF MELANOMA TUMOR DEPTH MEASUREMENT IN SEER**C Lam**¹, G Abastillas¹, X Wu², M Hsieh², S Negoita¹¹National Cancer Institute, Rockville, MD, United States; ²Louisiana Tumor Registry, New Orleans, LA, United States

Background: Breslow's thickness measurement describing depth of tumor cells invaded is required to stage skin melanomas. Coding errors involving implied decimal errors, transcription errors, and possible miscoding are commonly identified errors for manually abstracted melanoma cases.

Purpose: We aim to describe the magnitude of melanoma tumor depth coding errors in SEER consolidated tumor cases and propose a method for automated correction.

Methods: We will utilize malignant melanoma cases abstracted by the Louisiana Tumor Registry between 2010 and 2014. Linguamatics' I2E query development software will be used to identify and extract melanoma tumor depth measurements from abstracted text and electronic pathology (e-path) reports. The query algorithm will employ an ensemble of text mining methods such as extraction and search language, regular expressions, and string searches, to detect numeric values corresponding to melanoma tumor depth-related terminology or related code in absence of numeric values. Tumor depth values from abstracted text and e-path reports will be automatically coded, consolidated, and compared to gold standard values (cases re-abstracted and reconsolidated by experienced registrars). Agreement between algorithm generated and gold standard values will be compared with the agreement of original values. Errors will be classified by mechanism. Additional analyses will determine algorithm performance used to capture melanoma tumor depth measurements in source records.

Results: Precision, recall and F-score will be calculated to illustrate the algorithm performance. Non-inferiority testing will be conducted for Breslow values calculated algorithmically versus original Breslow values.

Conclusions: To ensure high-quality data in SEER, a review of melanoma tumor depth values and interpretation is necessary. This project will help SEER registries develop new and efficient processes to accurately capture and correct melanoma tumor depth.

P-22

DEATH CLEARANCE: CHANGING FOLLOW-BACK FOCUS FROM PHYSICIAN TO HAN FACILITY**K Harrington**¹, C Rao¹¹North Carolina Central Cancer Registry, Raleigh, NC, United States

An audit of NC death certificates revealed that 33% of cancer-related deaths occurred in a hospice, assisted living, or skilled nursing facility (HAN). A successful system for collecting HAN cases began in 2012. 1,215 HAN facilities have been recruited and submit 10,000 unique reports each year. 70% of these cases were confirmed to be reported. The CCR turned its focus on the most effective way to manage the 30% of non-matches with the goal of decreasing the DCO percent and time spent on follow-back. These cases were matched to the 2014 death list and 457 were identified which provided a primary facility for initial follow-back.

The NC death certificate provides the place of death and signing physician. The physician who signed the death certificate is contacted for patients who died at their residence. If the physician did not treat the patient, little information about the cancer may be known. Through the HAN reporting process, a cohesive level of understanding began to formalize. Many death certificate cases are signed by physicians who only saw the patient in a HAN facility or home care service. While the physician did not have information, the HAN facility often did. An extensive follow-back effort was undertaken when contacting physicians for 2014 death certificates who were asked leading questions as to their relationship with HAN facilities.

HAN reporting has made a significant impact on our DCO process by identifying the HAN facility as the primary follow-back resource as opposed to the physician. The combination of matching HAN reports to the death file and contacting the HAN facility as opposed to the physician has resulted in a significant reduction in the DCO percent. The percent dropped from 3% to 1% by 2013 after the initiation of HAN reporting and has further dropped to <1% due to the HAN follow-back effort for 2014 and 2015 deaths.

HAN reporting has improved awareness and communication between the CCR and HAN facilities. Physicians who work with HAN facilities are better educated regarding how to respond to requests from the CCR. And, the CCR's follow-back process has become more efficient as better sources for initial follow-back have been identified.

P-23

IMPROVING COMPLETENESS OF TREATMENT DOCUMENTATION THROUGH 15-MONTH RESUBMISSION OF DATA IN NEW JERSEY

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New Jersey State Cancer Registry (NJSCR) requires cases be submitted within 6 months of diagnosis or 3 months of discharge, whichever is sooner. While the Commission on Cancer (CoC) no longer requires hospitals to abstract cases within 6 months of first contact, the CoC is encouraging hospitals to abstract in a timelier fashion for the Rapid Quality Reporting System (RQRS). The increase in timely reporting of cases from hospitals may result in incomplete treatment reported to the central registry if treatment begins after case submission.

NJSCR responded to the SEER Rapid Response Surveillance Study Task Order Request for Proposals to test an innovative method for improving the completeness of treatment and other key data elements with 15-month resubmitted data from CoC hospitals. NJSCR selected seven CoC-accredited hospitals for participation in the study. The facilities were requested to resubmit all 2014 cases meeting the study criteria. NJSCR used a combination of manual and automated consolidation to update the registry abstract with data from the resubmitted records.

A total of 3,692 records were resubmitted. Of the resubmitted records, 727 (19.7%) were exact matches to the original record and were automatically deleted during the import process. Of the remaining 2,965 records, updates were made to 2,965 (53.6%) cases. Updates to treatment information ranged from 1% (surgery) to 27.3% (HTE). The proportion of cases beginning treatment more than 6 months after diagnosis ranged from 2.9% (chemotherapy) to 30.6% (hormone therapy).

NJSCR has determined that it is feasible to obtain additional information for critical data items from the 15-month resubmission of cancer case information. However, the resources necessary for conducting manual consolidation of these cases must be considered and minimized where possible. In order to incorporate 15-month resubmission into its standard operations, NJSCR will need to develop and test additional auto-consolidation routines.

P-24

DEFINING RISK FACTOR-ASSOCIATED CANCERS IN CANCER REGISTRY DATA

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Background: Some cancer types share common risk factors, such as tobacco use, alcohol use, human papillomavirus (HPV) infection, excess body weight, and physical inactivity. Because risk factor information is not routinely collected by cancer registries, estimates for risk factor-associated cancers often are based only on cancer type.

Purpose: We created user-defined SEER*Stat variables for risk factor-associated cancers.

Methods: We classified cases first by anatomic site, then by histology. Tobacco-associated cancers include cancers of the oral cavity and pharynx; esophagus; stomach; colon and rectum; liver; pancreas; larynx; lung, bronchus, and trachea; cervix; kidney and renal pelvis; urinary bladder; and acute myeloid leukemia. Alcohol-associated cancers include cancers of the oral cavity and pharynx, esophagus, colon and rectum, liver, larynx, and female breast. HPV-associated cancers include microscopically confirmed carcinoma of the cervix and squamous cell carcinomas of the vagina, vulva, penis, anus, rectum, and oropharynx. Cancers associated with excess weight include cancers of the colon, rectum, pancreas, postmenopausal female breast, corpus and uterus NOS (not otherwise specified), and kidney, and adenocarcinoma of the esophagus. Cancers associated with physical inactivity include postmenopausal female breast, corpus and uterus NOS, and colon cancers.

Results: Using standard definitions for risk-factor associated cancers can help facilitate comparisons of cancer burden across states and communities.

Conclusion: Keeping in mind that individual cancer cases may or may not be in persons exposed to a risk factor, population-based risk factor-associated cancer rates can help identify communities with disproportionately high cancer rates, which reflect, in part, exposure to cancer risk factors. These exposures can be reduced through clinical preventive services and community-based approaches, the impact of which can be monitored with cancer surveillance data.

P-25

ASSESSING THE ACCURACY OF REGISTRY-BASED TOBACCO USE STATUS AND UTILITY FOR PATIENT RECRUITMENT INTO TOBACCO TRIALSP Krebs¹, E Rogers¹, H Wong¹, JS Ostroff², **SJ Henley**³

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Background: Tobacco use among cancer patients negatively impacts treatment, survival, and quality of life outcomes. The use of cessation services and long-term abstinence can be increased when smokers are proactively contacted and offered treatment. To assess the reach and efficacy of proactive approaches to enroll cancer survivors in tobacco treatment, we are using data from cancer registries to identify patients who used tobacco at the time of cancer diagnosis and offer them active connection to the state quitline. This outreach requires accurate and timely data on tobacco use status.

Purpose: We compared data from the cancer registries with data from the patient's electronic health record (EHR) to see how well they matched.

Methods: Registry data for patients diagnosed during June 2014 to December 2016 were obtained from two cancer centers affiliated with New York University, and tobacco status was ascertained. For each patient identified as a current cigarette smoker, trained study staff abstracted tobacco use data from the EHR to independently code cigarette smoking status.

Results: Of 10,316 cancer patients at one study site, 577 (5.6%) were documented as current cigarette smokers using cancer registry data. Of these 577 patients, data in the EHR identified 71% as current cigarette smokers, 24.6% as former smokers, 4.5% as never smokers, and 4 as deceased. Comparisons at the second study site could not be accurately made for the 85 eligible patients as the EHRs had no consistent nor reliable record of tobacco use status.

Conclusions: Tobacco use status in the cancer registry was consistent with the EHR for most, but not all, cancer patients. For registries to be useful as a valid source for identifying tobacco users, accuracy must improve. Standardized fields and validated tobacco use questions could aid providers in reliably documenting tobacco use in EHR and registry data, thus improving the utility of these data in future studies.

P-26

RESUBMISSION OF DATA FROM HOSPITALS TO IMPROVE COMPLETENESS OF TREATMENT DATA: A PILOT STUDYC Phillips¹, L Gonsalves¹¹Connecticut Tumor Registry, Hartford, CT, United States

Background: Central cancer registries generally require hospitals to submit cases within 6 months of diagnosis or first contact for cancer treatment. This may lead to central registries receiving incomplete treatment information from the hospitals, and could be due to a number of factors including a prolonged first course of therapy, delays in treatment, and delays in hospital registries obtaining/ updating information. In 2015, CTR was funded by SEER to explore an innovative method to improve the completeness of treatment data in the CTR database through file resubmissions from CoC hospitals in the state.

Study Aim: To examine the value of obtaining updated information from resubmitted CoC hospital data through assessment of the completeness and specificity of treatment, staging, and prognostic data.

Methods: Resubmissions files were requested for cancers diagnosed in 2014 for the following cancer types: breast, colorectal, lung, prostate, urinary bladder, pancreas and NHL. The post-resubmission data were compared with an extract created prior to resubmission. Analyses were undertaken to identify changes in treatment, staging, and prognostic data variables. In addition, the lag time between diagnosis and treatment was calculated and treatments initiated more than 6 months after diagnosis identified.

Results: Post-resubmission, the largest increases in treatment recorded were observed for radiation and hormone therapy for breast cancer patients. Treatment initiated more than 6 months after diagnosis was highest for breast cancer radiation and hormone therapy, and for pancreatic cancer radiation therapy. Only modest changes were seen for treatment coding specificity, and for staging and prognostic data.

Conclusions: While some improvements were seen particularly for breast cancer radiation and hormone therapy, this exercise was quite work-intensive. Potential benefits need to be weighed with respect to the additional time required to process the resubmitted data.

P-27

USE OF GEORGIA CANCER REGISTRY DATA FOR CANCER PLANNING: GEORGIA'S APPROACH

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Background: In 2014, the Georgia Comprehensive Cancer Control Program (GCCCCP) in collaboration with the Georgia Cancer Control Consortium published the Georgia Cancer Strategic Plan 2014-2019 (GCP). In Georgia (GA), cancer is the second leading cause of death. The plan promotes 8 priorities to address for the next 5 years, which are centered on cancer prevention and control in GA: tobacco use and obesity, Human Papillomavirus (HPV) vaccination, cancer screening, quality of cancer diagnosis/treatment, palliative care and survivorship, and patient case management and care coordination. GA has five Regional Cancer Coalitions (RCC) which promote cancer control activities to citizens in their communities. The GCP builds upon the existing partnerships with other public health sectors and stakeholders to promote the prevention and control of cancer among Georgians.

Purpose: To provide cancer related data on the 8 priorities outlined in the GCP for counties served by the 3 active RCC.

Methods: Incidence, mortality, stage, and survival data for all sites, breast, cervical, colorectal, and lung cancers by sex and race were obtained from the GA Comprehensive Cancer Registry (GCCR). Cancer screening data, cancer survivor prevalence, and GA adult smoking trends were obtained from the Behavioral Risk Factor Surveillance System. U.S. adult smoking trends were obtained from the National Health Interview Survey. GA lung cancer screening sites data were obtained from the GCCCCP. GA School Health Profiles and tobacco data were obtained from the GA Tobacco Use Prevention Program. Data were obtained from the National Immunization Survey-Teen for HPV vaccination prevalence among adolescents. Lastly, GA HPV vaccine stock data were utilized as well as GA HPV-attributable cancers data from GCCR.

Results: In progress. Results expected June 2017.

Conclusion: Data are used by the RCC to guide planning and allocation of resources for cancer prevention and control, targeting disparate populations, to achieve goals set in the 2014-2019 GCP.

P-28

RECOVERING TREATMENT IN PUERTO RICO: AN AGREEMENT EVALUATION USING ADMINISTRATIVE CLAIMS DATA

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Background: Over the years, Puerto Rico Central Cancer Registry (PRCCR) has been implementing different strategies to improve quality of data. Information about treatment is not reliable due to high proportion of unknown chemotherapy (CT) and radiation (RT) variables. PRCCR law allows to request insurance companies' administrative claims. An agreement was established with six insurance companies to receive their claims data. This represents more than 80% of Puerto Rico's (PR) insured population. For years 2009-2013, more than 75% of claims database (DB) was linked with PRCCR DB.

Purpose: To evaluate the potential use of private and public health insurance claims to improve CT and RT variables for lung, pancreas, bladder, ovary, cervix, colon, and rectum cases from 2009 to 2013 in PRCCR DB.

Methods: PRCCR data used for this study included patients with only one malignant tumor from lung, pancreas, bladder, ovary, cervix, colon, and rectum for years 2009-2013 diagnosed in PR. Cases with type of reporting source of autopsy only and death certificate only were excluded. Claims DB includes patients with at least one claim with CPT code related to CT or RT 1 year after diagnosis date. PRCCR developed a match similar to the SEER-Medicare to perform a linkage between PRCCR and Claims DB. A concordance analysis was performed to calculate the agreement for CT and RT.

Results: From 10,980 patients with a primary included in this study, 9,022 (82.17%) matched with Claims DB. CT agreement for the studied cancers combined was moderate [71.34% (k=0.43)]. RT agreement for these cancers was 91.65% (k=0.74). One third (31.66%) of unknown CT treatment can be recovered through Claims DB.

Discussion: Moderate agreement for CT can be explained by a high proportion of false negatives cases in PRCCR DB. Claims DB proves to be a valuable source to improve CT and RT unknown treatment variables. This study can be expanded to include other primaries and treatment modalities.

P-29

AUTOMATED TUMOR LINKAGE AND THE FUTURE OF QUALITY CONTROL**S Wood¹**, M Brant¹¹CalCares/University of California Davis Health Systems, Sacramento CA, United States

Background: The California Cancer Registry began implementation of automated tumor linkage to our Database Management System in 2013. Our tumor linkage logic covers the most common sites incoming cases link automatically nearly 80% of the time. This logic has been adjusted to best fit the incoming data as well as account for various levels of data specificity.

Purpose: In our continued quality control activities to ensure the accuracy of our rules, we have determined that the biggest “weakness” is that linkage will occur incorrectly if the cases are not coded accurately. As text to code review is done less frequently than in the past, we are forced to find new ways to identify and correct data quality issues. While we have adjusted the rules so that we do not create new tumors when the data is vague we have identified a need to ensure that tumors created in our automated process are done correctly.

Methods: I am proposing that we investigate and audit our automated tumor linkage in the cases where we create new tumors automatically. To do this I will analyze the cases involved where the linkages have been altered in our system after automated linkage was performed. This analysis will focus on potential coding errors as well as accounting for common misuses of multiple primary rules and cases involving metastasis.

Results: The results of this analysis will give us insightful ways to identify patterns where linkage may have been performed based on inaccurate coding/abstracting. After the scenarios are identified an appropriate quality control apparatus can be implemented to ensure that the data is correct in the most efficient way possible. This process may be two-tiered as potential cases can be reviewed and complete or sent for more thorough review.

Conclusion: This analysis and methodology could serve as a model to focus quality control on areas that are problematic and efficiently perform focused ongoing quality control on the data that is most problematic.

P-30

THE COMPLETION OF CHRONIC COMORBIDITY REPORTING FROM HOSPITAL INPATIENT DISCHARGE DATA VARIES BY OBSERVED TIME WINDOWS**Y Yi¹**, M Hsieh¹, X Li¹, X Wu¹¹Louisiana Tumor Registry, New Orleans, LA, United States

Objectives: Hospital inpatient discharge data (HIDD) contains diagnosis codes for the admissions. This might help complete the cancer registry's comorbidity data. In order to capture a patient's comorbid conditions, we need to trace back the patient's admission history. There is no clear rule on how far back we should go. The objectives of this retrospective cohort study is to assess the impact of the width of the time window on the completeness of comorbidity.

Methods: From the Louisiana Tumor Registry database, we selected cancer cases diagnosed in 2011-2013 for certain cancers. The data was linked with HIDD (2008-2013), and the linked patients form the patient cohort. We considered chronic illnesses based on Charlson comorbidity Index. Four time windows of different widths were applied on the patient cohort, specifically, 1 year (2 years, 3 years, and 4 years) prior to the diagnosis. The period within 30 days of the diagnosis was excluded to avoid any confounding due to cancer diagnosis and treatment. Then, we used ICD-9-CM diagnosis codes to extract comorbid conditions for each of the four time windows, and compared the result.

Results: 2,571 out of 3,022 (85.1%) of LTR patients were linked to HIDD data. Among the 2,571 patients, 19.1% (492 patients) were found with 1,065 comorbid conditions using the 1-year window. When we expanded the time window to 2 years, 3 years, and 4 years, the percentage went up to 26.5%, 31.0%, and 34.5%, respectively. In other words, the percentage increased by 0.8 time using 4-year window compared to using 1-year window.

Discussion: HIDD data might be a convenient supplemental source for documenting comorbidities in cancer registry database. Increasing the width of the time window greatly helps capture comorbid conditions that could be missed by using narrow windows. However, expanding the width of the window needs to take the life span of the specific disease into account.

P-31

LEVERAGING BUSINESS INTELLIGENCE TOOLS IN SUPPORT OF CANCER CASE ACQUISITION AND AUTO VERSUS MANUAL PROCESSING OF DATA

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Background: Data collection and registry operations are increasingly dependent upon information technology to acquire, process, and store source documents. The accumulation of data significantly increases the efforts necessary to process all cancer cases in an efficient manner while maintaining the necessary data quality and financial effectiveness. For many years, the California Cancer Registry (CCR) has relied on many static reports to monitor common operations. While these reports were effective in addressing the specific questions they were developed for, there are still many overlooked business processes and new unanswered questions, especially on new automated tasks. A decision was made that a new business intelligence (BI) solution would help with these challenges.

Method: In Phase 1 of the BI solution, hospital abstracts were analyzed as they were processed serially through the system. In phase 2, each business process was analyzed on its own and reusable metrics have been developed to be used by different categories of users. Next, the source data was identified and necessary ETL processes have been developed to populate the new created dimensional model data warehouse. As a tool, the Microsoft BI stack was chosen for this purpose mainly because of availability, accessibility, and its recent advancements in BI arena.

Results: The new BI solution allowed self-service BI and creating ad hoc reports on request. Several Excel reports have been created and are being generated every week to monitor auto and manual activities related to quality control, linkage, and consolidation. In the last 2 years, we were able to target resources to automate many complex activities, saving at least 2 FTEs per year.

Conclusion: It is clear that monitoring of main business processes allows faster enhancements to the system and day-to-day operations, which otherwise would be harder to achieve. This poster will demonstrate savings in manual works tasks and wise use of resources.

P-32

BIOREPOSITORIES AND CANCER REGISTRIES: THE PERFECT MATCH

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Background: Cancer registries collect data on demographics, tumor characteristics, and treatment, using standard layouts and codes and adhering to strict guidelines for data security and protection of sensitive patient health information. Treatment options are expanding as we enter an era of “personalized medicine” but results of genomic and proteomic testing are not yet being collected in a standardized or systematic form, to be available as needed. Biorepositories store and process biospecimens for use in research and clinical care. Biorepositories have developed from institutional repositories to population-based biobanks and more recent virtual biobanks. Linking biorepository records with a central cancer registry database could benefit clinicians and researchers and expand data usage.

Purpose: To demonstrate the feasibility and utility of linking a biorepository database with a central cancer registry database.

Methods: Based on our previous experience with data linkages, we will link two datasets. The University of Missouri (MU) Biorepository contains tissues deposited between 2000 and 2015 from approximately 1,500 individuals. The Missouri Cancer Registry (MCR) database contains over one million records, with around 600,000 being collected between 1996 and 2015.

Results: We will report on linkage results. The records will be split by site and pathology.

Discussion: Demonstrating that linkages can be very beneficial collaborations for cancer registries to strengthen existing and establish new collaborations and reporting mechanisms. Cancer registries are important partners of cancer researchers and can provide important and needed information.

Conclusions: This linkage demonstrates that cancer registry data and tissue samples can be linked and enrich the environment for researchers and cancer control activities based on this enhanced and readily available important information.

P-33

ENDLESS OPPORTUNITIES: INTERNATIONAL AND NATIONAL COLLABORATIONS TO ADDRESS AND SOLVE CANCER REGISTRY CHALLENGES**J Jackson-Thompson**^{1,2,3}, I Zachary^{1,2}, U Khan⁴¹University of Missouri Health Management and Informatics, Columbia, MO, United States; ²University of Missouri Missouri Cancer Registry and Research Center, Columbia, MO, United States; ³University of Missouri MU Informatics Institute, Columbia, MO, United States; ⁴University of Missouri Department of Endocrinology, Columbia, MO, United States

Background: Cancer registries in North America have long histories of collecting data in a standardized and efficient way to support disease surveillance, practice, and research. Cancer registries in developing nations do not have this same history. The expansion of cancer reporting in the U.S. to include physicians and facilities without cancer registries increases the utility of, and need for, addressing and solving some common challenges: rural areas, disparities, and training of providers and cancer reporters.

Purpose: To address questions that exist across borders (e.g., rural versus urban areas, training for providers and cancer reporters, coding, reporting options, collection of minimum data elements) and explore enhancing networks of scientific collaboration nationally and internationally.

Methods: The Missouri Cancer Registry and Research Center (MCR-ARC) partnered with a physician in Kabul, Afghanistan who wanted to establish a hospital-based cancer registry. MCR-ARC staff met with five physicians from Kabul, collaborated in establishing cancer registries in resource-poor clinical settings, and shared resources and experiences to address these clinical settings.

Results: A hospital in Kabul established a 21-bed cancer unit this year; a team came to the U.S. in February and is in the process of setting up a basic cancer registry.

Discussion: Existing central registries can assist other registries in establishing first steps and share experiences to shorten and encourage the process of setting up new registries. Both registries learn from these experiences how to address challenges in not always ideal circumstances.

Conclusions: Cancer registries that are successful can share and collaborate with partners who are in the process of setting up new cancer centers and registries. This demonstrates that cancer registry train-the-trainers for large, medium and small registries can be a successful partnership.

P-34

EVOLUTION OF THE METRO CHICAGO BREAST CANCER REGISTRY (MCBCR)G Rauscher¹, **T Dolecek**¹, F Dabbous², A Hughes¹, T Macarol², W Summerfelt²¹University of Illinois at Chicago, Chicago, IL, United States; ²Advocate Health Care, Downers Grove, IL, United States

Background: The Metro Chicago Breast Cancer Registry (MCBCR) began as a project, *Comparative Effectiveness of Breast Imaging Modalities: A Natural Experiment*, funded by AHRQ that linked Illinois State Cancer Registry (ISCR) breast cancer incidence data with administrative radiology data (Penrad) from a single health care organization with locations throughout the Metropolitan Chicago area. Subsequently, MCBCR became one of six registries nationwide contributing to the collaborative efforts of the Breast Cancer Surveillance Consortium (BCSC).

Purpose: To report selected results from MCBCR studies as well as nationally through BCSC research.

Methods: Female breast cancer incidence data from ISCR were linked using probabilistic methods to the Penrad radiology database. Three linkages were conducted over 2010-2016 producing matched breast cancer to radiology record analytic datasets totaling 22,741, 28,119, and 30,863 records for diagnosis years 2001-2011, 2001-2012, and 2001-2013, respectively. These datasets were augmented with survey data on radiology personnel and facility characteristics as well as enhanced completeness of data such as health insurance with organizational database resources.

Results: MCBCR studies revealed that the burden of a false positive result and associated diagnostic workup did not change with transition to full field digital mammography and discontinuation of screen film mammography which began in 2005 and was complete by the end of 2010. Interval breast cancer was (as expected) associated with more aggressive tumor characteristics, younger age, denser breasts, and non-Hispanic white race/ethnicity. A false positive screen was associated with delayed return for the next expected regular screen. Additional findings from MCBCR and BCSC will be discussed.

Conclusions: MCBCR and BCSC studies help to inform women, clinicians and policy makers on issues related to screening and breast cancer care decision making in community clinical settings.

P-35

TRENDS IN COLORECTAL CANCER SURVIVAL IN THE ARAB WORLD, 1990-2009

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Introduction: Cancer survival is a key measure of the effectiveness of healthcare systems. Globally, colon and rectum cancer ranked third for cancer incidence and fourth for cancer death in 2013. For developed countries it ranked second for incidence and mortality, and in developing countries it ranked fourth for both incidence and mortality. An increasing trend in incidence is reported from various registries of Arab world; Kuwait and Saudi Arabia present the highest incidences worldwide.

Material and Methods: This report is a summary of the two survival figures of CONCORD Study 1 (1990-1994) and CONCORD Study 2 (1995-2009). Individual colon and rectum tumor records were submitted by six population-based cancer registries in Arab countries (Jordan, Saudi Arabia, Qatar, Algeria, Libya, and Tunisia) for 9,050 patients (15-99 years) diagnosed during 1990-2009 and followed up to December 31, 2009. Estimated 5-year net survival was adjusted for background mortality by single year of age, sex, calendar year in each country.

Results: For patients diagnosed during the period 2005-2009, the age-standardized 5-year net survivals were respectively higher, 68.2% for colon cancer and 77.8% for rectum cancer in Qatar and the lowest rate for rectal cancer, 21% in Jordan, between 1995-1999 and 2005-2009, Survival increased in Algeria, but this trend is less reliable.

Conclusions: Comparison of population-based cancer survival from the CONCORD study showed very wide variations in survival from colorectal cancer in Arab world. Cancer survival research is being used to formulate cancer control and the need to implement effective strategies of primary prevention.

P-36

THE DESCRIPTIVE EPIDEMIOLOGY OF GYNECOLOGIC CANCERS: AN INTERNATIONAL COMPARISON OF INCIDENCE, SURVIVAL, AND MORTALITY

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Introduction: Gynecologic cancers are the most common cancers in women. In 2012, cervical cancer (CC) ranked as the fourth most common cancer, with an estimated 528,000 new cases, and ovarian cancer (OC) was the seventh most common for females, with nearly 239,000 new cases worldwide.

Methods: The incidence and mortality statistics presented for GC worldwide were taken from the International Agency for Research on Cancer IARC: The Cancer Incidence in Five Continents Vol X and the GLOBOCAN database, 2012. The data for cancer survival were taken from Cancer Survival in Five Continents, a worldwide population-based study (CONCORD) version 2, 1995-2009. Estimated 5-year net survival was adjusted for background mortality by sex and calendar year in each country.

Results: CC is the most common cancer among women in 45 countries, mainly in sub-Saharan Africa, part of Asia, and Central and South America. The lowest incidence rates are in Western Europe, North America, Australia, and the Eastern Mediterranean. Almost 55% of all new cases of OC occurred in countries with a very high level of human development, mainly Northern Europe and America, and Oceanic, Africa presents the lowest incidence. Data for CC are available for 602,225 women, CC survival was 50% or higher in most countries, except for Libya (Benghazi, 39%) and India (Karunagappally, 46%). During 2005-09, age-standardized 5-year net survival was 70% or higher in Iceland, Mauritius, Norway, South Korea, and Taiwan. For Qatar, it is also above 70% (based on only 16 cases and not age-standardized). Data for OC are available for 779,302 women, during 2005-09, the age-standardized 5-year net survival was 40% or higher in Ecuador, the U.S., nine countries in Asia, and eight countries in Europe. Survival in other countries was mostly in the range 30-40%.

Conclusions: The evolution of cancers in women shows a consistent and very striking pattern during the epidemiological transition with rapid declines in the incidence of cervical cancer.

P-37

ASSESSING THE EFFECTIVENESS OF THE ENGLAND-WIDE BE CLEAR ON CANCER CAMPAIGNSG Johal¹, K Haddock¹, V Mak¹, L Elliss-Brookes¹¹National Cancer Registration and Analysis Service, Public Health England, London, Great Britain

Background: Be Clear on Cancer campaigns have been used in England since 2011. They aim to improve early diagnosis of cancer by raising public awareness of the signs and symptoms of cancer, and by encouraging people to see their GP without delay. Public Health England has responsibility for evaluation of all campaigns implemented from April 2013 onwards. Each campaign is tested locally and regionally, then rolled out nationally if proven to be effective.

Evaluation results will be presented for five England-wide campaigns: Urological (blood in pee); Bowel (blood in poo); Breast (aged over 70); Lung (3 week cough); and Oesophago-gastric cancers (heartburn or food sticking).

Methods: Evaluation measures were agreed before each campaign. Key metrics included: public awareness of key campaign messages, attendances at primary care, primary care referrals, diagnostic tests and cancer diagnoses. Each campaign ran over set time periods (typically 6-12 weeks), between 2012 and 2015.

Results: Metric results will be presented as infographics for each campaign. All campaigns raised public awareness of signs and symptoms of cancer, and encouraged people to see their primary care doctor as early as possible. There were significant increases in the number of primary care referrals. Measurements across each metric in the patient pathway were used to produce a full evaluation of the campaigns, including examination of the impact by age, sex, and socio-economic status.

Conclusions: Robust evaluation of the Be Clear on Cancer campaigns has contributed to the evidence base for early diagnosis and the need to raise the awareness of cancer symptoms.

Analysis of the evaluation metrics by age, sex and socio-economic status allows us to understand much better where the campaigns are having an impact and if they are reaching the target audience.

P-38

FREQUENCY OF SYNCHRONOUS BRAIN METASTASES AT TIME OF PRIMARY CANCER DIAGNOSIS IN THE US, 2010-2013C Kromer¹, J Xu², QT Ostrom^{3,4}, C Kruchko⁴, R Sawaya⁵, JS Barnholtz-Sloan^{3,4}

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Background: Brain metastases (BM) are one of the most common types of brain tumors and are a relatively common event in the disease process for several high-incidence cancers, including breast and lung cancers. Historically, information on BM has not been collected as part of national cancer registration in the U.S., but BM at time of primary cancer diagnosis (SBM), is now collected by the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) system since 2010.

Methods: Using data from 18 SEER registries from 2010 to 2013, we assessed the frequency of SBM at time of primary diagnosis in the U.S. by site, histology group, sex, race, age, and insurance status.

Results: There were 1,348,131 total primary cancer cases in SEER from 2010-2013, 1.7% of which presented with SBM. The cancer type with the highest proportion of SBM was lung cancer (10.8% of cases with SBM), followed by esophageal (1.5%), kidney (1.4%), and melanoma (1.2%). SBM varied by age, sex, race, and insurance status for most histologies.

Conclusions: Our results reflect the high proportion of patients who are diagnosed with lung cancer at late stages and present with SBM, in contrast to other common cancers in the U.S. where BM often occurs later in the disease process and after treatment. Demographic variation in molecular subtype and risk behavior may influence variation in SBM. BM is a relatively common event in late stage cancer and cause significant morbidity and mortality, and assessment of accurate population-based data is critical to estimate total disease burden.

P-39

CANCER AND HEART DISEASE AGE-ADJUSTED MORTALITY TRENDS IN CALIFORNIA FROM 1970 TO 2014

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Background: The leading causes of mortality in the United States are heart disease and cancer. Mortality trends in the United States have changed in recent years, with cancer mortality counts surpassing heart disease mortality counts for Hispanic and Asian/Pacific Islander (PI) populations (Heron, 2016). The purpose of this study was to examine if a similar pattern is reflected in California with age-adjusted mortality rates by race, and investigate the relationship between mortality rates by sex.

Methods: The mortality rates for Californians over age of 20 were used for this study. The age-adjusted mortality rates were calculated by year of death and stratified by either race or sex using SEERStat version 8.3.2.

Results: Cancer age-adjusted mortality rates have surpassed heart disease rates as the leading cause of death for Non-Hispanic whites, Hispanics, and Asian/PI in California. The rates for Hispanics and Asian/PI were significantly different. This trend was not seen for African Americans or American Indians. When the age-adjusted mortality rates were examined by sex in California in 2014, the mortality rate for cancer is significantly higher than heart disease mortality for females; however, males have a higher mortality rate for heart disease.

Conclusion: The leading cause of death for Non-Hispanic whites, Hispanics, and Asian/PI in California has changed in recent years, in that cancer mortality has surpassed heart disease mortality as the leading cause of death. This trend is also seen among females in California. These changes in mortality trends could be due to an increasingly older population. Trends suggest that similar patterns of mortality will be seen in African Americans, American Indians, and males within upcoming years.

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P-40

OBESITY AND THE IMPACT ON ENDOMETRIAL CANCER IN OKLAHOMA

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Background: In 2014, Oklahoma ranked sixth highest in the U.S. for the proportion of the population that was obese.¹ It is thought that 56.9% of endometrial cancers in the U.S. are attributable to being overweight or obese.² While most endometrial cancers occur among postmenopausal women, younger women exposed to high levels of estrogen as a result of obesity are at risk. Currently, there are no screening tests to diagnose endometrial cancer at early stages. The effects of obesity can also complicate clinical management of endometrial cancer.²

Methods: The Oklahoma Central Cancer Registry is a population-based system collecting data on cancer cases diagnosed and/or treated in Oklahoma. Endometrioid adenocarcinoma (type-1 endometrial cancer) cases were extracted. Age-adjusted incidence rates for endometrial cancer were calculated by year. The Body Mass Index (BMI) from self-reported height and weight in the Oklahoma Behavioral Risk Factor Surveillance System was assessed.

Results: Between 2000 and 2014, there were 3,683 type-1 endometrial cancer cases. Age-adjusted incidence rates demonstrated an upward trend; increasing from 7.1 cases per 100,000 women in 2000 to 16.6 per 100,000 in 2014. The proportion of women that were obese based on BMI data, increased from 20% in 2000 to 31% in 2010 and 31% in 2011 to 33% in 2014.

Conclusion: The rise in endometrial cancer incidence rates and proportions of obesity further highlights the need to educate the public on the impact of obesity on cancer outcomes. An active prevention approach can not only help reduce cancer risk but also preserve fertility in young women.

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P-41

CANCER PREVALENCE IN CALIFORNIA ON JANUARY 1, 2013Y Chen¹, F Maguire¹, C Morris¹, A Parikh-Patel¹, K Kizer¹¹California Cancer Reporting and Epidemiologic Surveillance (CalCARES) Program, University of California Davis Health, Sacramento, CA, United States

Background: Cancer prevalence is the number of people in a population on a certain date who have ever had a diagnosis of cancer. It is an important indicator for epidemiologists and public health advisors since it reflects not only the number of people with active disease but also the number of survivors who may suffer from long-term effects of treatment.

Purpose: To describe the burden of cancer in California on January 1, 2013, by estimating the prevalence of 21 common cancer sites and the prevalence of the most common types of cancer diagnosed in children and adolescents.

Methods: The complete prevalence at January 1, 2013 was calculated using COMPREV software for cancers of the: female breast, prostate, colon and rectum, skin (melanoma), thyroid, uterus, bladder, non-Hodgkin lymphoma, lung and bronchus, kidney and renal pelvis, leukemia, cervix, oral cavity and pharynx, testis, ovary, Hodgkin lymphoma, brain and central nervous system, stomach, liver, larynx, and pancreas. Limited-duration prevalence for childhood and adolescent cancer groups was calculated using the counting method in the SEER*stat software for the period 1988 to 2013.

Results: More than 1.4 million people with a history of one of the 21 most common cancers were alive in California on January 1, 2013. Female breast, prostate, and colorectal cancers were the most prevalent cancers. More than 30,000 people with a history of childhood or adolescent cancer were alive in California on January 1, 2013. Leukemias, lymphomas, and central nervous system neoplasms had the greatest prevalence. Overall, Marin County, Nevada County, and counties in the High Sierra region had the greatest cancer prevalence.

Conclusions: Cancer prevalence information can be used for health planning and to direct improvements in cancer care so that all people living with a cancer diagnosis receive the support they need.

P-42

TRENDS IN CANCER SURVIVAL IN CALIFORNIA BY HEALTH INSURANCE STATUS: 1997 TO 2013A Canchola¹, S Gomez^{1,2}¹Cancer Prevention Institute of California, Fremont, CA, United States; ²Stanford Cancer Institute, Stanford, CA, United States

Background: Over the last few decades, there have been vast improvements in the early detection and treatment of cancer in the U.S., with corresponding improvements in survival and reductions in cancer mortality. However, it is not clear to what extent patients with different types of health insurance have benefitted from these advancements. We examined trends in survival by health insurance status for the five most common cancers in California.

Methods: Tumor records from the California Cancer Registry were used to estimate trends in population-based all-cause and cancer-specific survival for patients diagnosed with either breast, prostate, colorectal, or lung cancer, or melanoma. Cox Proportional Hazard models were used to examine 5-year survival by health insurance status (Private only [reference], Medicare, any Medicaid/Military/Public, None) for two time periods: 1997-2002 and 2003-2008, with follow-up to 2013.

Results: Survival disparities for patients with public or no insurance were stark, especially for melanoma. For breast and colorectal cancer, disparities increased over time. Uninsured breast cancer patients had 41% higher cancer-specific mortality than privately insured patients in period 1, increasing to 58% in period 2. Publically insured BC patients had 21% higher mortality, increasing to 28%. Uninsured colorectal cancer patients (men) had 18% higher mortality in period 1, increasing to 32% in period 2. Publically insured CRC patients had 12% higher mortality in period 1, and 13% higher in period 2. For prostate and lung cancers, survival disparities reduced to non-significant levels over time.

Conclusions: Cancer survival varied dramatically by type of health insurance. Uninsured and publically insured patients experienced large survival deficits compared to privately insured patients, and for some cancers, disparities increased over time. It is unclear yet whether increasing health insurance coverage through the Affordable Care Act had any impact on reducing these survival disparities.

P-43

THE IMPACT OF OBESITY ON DEPRESSION AMONG ADULT CANCER SURVIVORS RESIDING IN BRAZIL

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The bidirectional association between obesity (O) and depression (D) in the general population has already been established.¹ This association has also been investigated among cancer survivors, though mostly in North America.² These findings may not necessarily apply to all the populations across the world due to varying factors such as culture and economy. There is very limited literature investigating this association among South American cancer survivors. The purpose of the current study is to evaluate the association between O and D among adult cancer survivors residing in Brazil.

To this end, we will use the Brazilian National Health Survey (BNHS) data, which is a national household based survey conducted in Brazil from August 2013 to February 2014. The present study will use data collected on 786 Brazilian adult cancer survivors who responded to BNHS. Multivariable weighted logistic regression analyses will be performed to investigate the association between O and D in this population, while adjusting for possible confounders such as: gender, race, age, physical activity, number of depression related comorbidities, marital status, education, and insurance. All statistical analyses will be performed using SAS v9.4, with the statistical significance level set at 0.05. The results of the present study will help to better understand factors associated with depression among cancer survivors residing in Brazil, in the current cultural and economic context.

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P-44

STAGE-SPECIFIC CANCER SURVIVAL IN ENGLAND

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Background: Patients diagnosed at a late stage of disease are known to live for a shorter amount of time and also require more complex interventions. The completeness of staging data in newly diagnosed tumors was greater than 60% in England for the first time in 2012 and was 77% in 2014. Because of this transformation in the collection and reporting of staging data, Public Health England's National Cancer Registration and Analysis Service (NCRAS) and the U.K. Office for National Statistics (ONS) are now in a position to be able to quantify the effect of stage at diagnosis on 1-year survival.

Methods: Patient data was analyzed for 600,428 tumors diagnosed between 2012 and 2014 in nine cancer sites: bladder, female breast, colorectal, kidney, lung, melanoma, ovary, prostate, and uterus. After obtaining follow-up information and cleaning the data, 1-year age-standardized net survival by stage, and survival combining all stages, was calculated for men and women as appropriate.

Results: In general, those people diagnosed with early (stage 1 or 2) cancers have a better survival than those diagnosed with late (stage 4) cancer. Apart from lung and ovarian cancer, there tends to be a pattern of similar survival at stages 1-3 and a large decrease for those diagnosed at stage 4. The survival for stage 4 cancers varies from 15% (male lung cancer) to 83% (prostate cancer). For lung cancer, the poor overall survival is heavily affected by the proportion of late diagnoses, as stage 1 lung cancer has survival of 81-85%.

Conclusions: Diagnosing patients at the earliest possible stage has a significant impact on outcomes for patients, which vary by tumor site and gender. The underlying genetics of the cancer and varying treatment options for advanced disease will also contribute to variation. The results for 2015 diagnoses will be reported in June 2017.

P-45

30-DAY MORTALITY FOLLOWING SYSTEMIC ANTI-CANCER THERAPY FOR BREAST AND LUNG CANCER: WHICH FACTORS INCREASE THE RISK?M Wallington¹, E Saxon², M Wickenden², L Hounsborne¹, M Bomb², D Dodwell¹, R Smittenaar²¹Public Health England, London, Great Britain; ²Cancer Research UK, London, Great Britain

Background: 30-day mortality may be a useful indicator of avoidable harm to patients from systemic anti-cancer therapies, but data on this has so far been limited. The English Systemic Anti-Cancer Therapy (SACT) dataset allows us to assess factors affecting 30-day mortality in a national patient population. Here, we report the first insights from analyses for breast and lung cancer.

Methods: Using the SACT dataset, we calculated 30-day mortality following the most recent cycle of SACT between Jan-Dec 2014 for breast and lung cancer patients in England. We performed regression analyses, adjusting for relevant factors, to examine whether patient, tumor, or treatment-related factors were associated with the risk of 30-day mortality.

Results: 30-day mortality was higher for a number of factors including: breast cancer and NSCLC patients receiving their first reported curative or palliative SACT treatment ('treatment-naïve') vs. those who received SACT previously (breast palliative: adjusted odds ratio, OR 2.46; NSCLC curative: OR 3.87; NSCLC palliative: OR 3.09); patients with the worst performance status (PS) 2-4 vs. PS 0 (breast curative: OR 7.35; breast palliative: OR 6.18; lung, palliative: OR 3.34); breast cancer patients aged 60-69 and 70+ vs. those aged 50-59 (OR 4.35 and 6.37) given curative SACT; breast cancer patients aged 24-49 vs. aged 50-59 (OR 1.37) given palliative SACT; and NSCLC patients aged 24-64 vs. aged 65-74 (OR 1.25) given palliative SACT.

Conclusion: In summary, our analysis of the SACT database (with linkage to the NCRS for morphology, stage at diagnosis and mortality information) gives us important initial insights into 30-day mortality in a large, representative population of breast and lung cancer patients receiving systemic anti-cancer therapy for cancer in England, indicating that treatment intent, patient age, performance status, whether patients had received previous SACT, and gender all affect 30-day mortality risk

P-46

COLORECTAL CANCER INCIDENCE TRENDS IN MASSACHUSETTS BY TUMOR LOCATION, 1995-2014A MacMillan¹, S Gershman¹¹Massachusetts Cancer Registry, Boston, MA, United States

Purpose: Some studies suggest that screening colonoscopies are more effective in finding left-sided colorectal cancer (CRC) than right-sided, and that etiologies may differ by subsite. This project evaluated CRC incidence trends in Massachusetts by tumor location (right-sided vs. left-sided) for the period 1995-2014, and described patterns of right-side (proximal) and left-sided (distal) CRC incidence by population demographics and stage.

Methods: Age-adjusted incidence rates were calculated for overall invasive CRC and by subsite. Trends were analyzed using Joinpoint Regression Program software version 4.1.1.5. Subsite-specific proportions were examined by time period, gender, age group, race/ethnicity and summary stage.

Results: From 1995-2014, 71,388 cases of invasive CRC were diagnosed among Massachusetts residents (29,516 right-sided, 37,261 left-sided, 4,611 other). For males, annual rates of left-sided CRC cancer were significantly higher than for right-sided colorectal cancer, while for women, beginning in 1999, rates of left-sided and right-sided CRC cancer were quite similar. Male left-sided CRC rates decreased significantly by 1.6% per year for 1995-2002, and significantly by 5.6% per year for 2002-2012. Significant decreases of male right-sided CRC occurred later—5.4% per year for 2003-2014. Female left-sided CRC had significant decreases from 2002-2007 (5.7% per year), and from 2007-2014 (2.8% per year). Female right-sided CRC decreased significantly by 4.0% per year from 2002-2014. Males and females <50 years of age were more likely to be diagnosed at late stage than those aged 50 and above for both right and left-sided CRC. Right-sided CRC had the highest proportions of late stage diagnoses among males and females. The percent of localized right-sided CRC increased from 27.2% in the earliest period examined (1995-1999) to 42.1% in 2010-2014. For the same periods, localized left-sided CRC cancer increased from 35.8% to 43.3%.

P-47

A COUNTY-LEVEL ECOLOGICAL EXAMINATION OF CANCER SCREENINGS, EARLY STAGE INCIDENCE AND MORTALITY IN THE STATE OF MISSOURI

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Background: Population-based evidence about the effectiveness of cancer screenings and cancer outcomes in Missouri (MO) is lacking. The study examined whether screenings of breast cancer (BC), cervical cancer (CC) and colorectal cancer (CRC) impact early stage cancer incidence and mortality in MO counties.

Method: County-specific prevalence of screenings, including clinical breast exam (CBE), mammography, Pap test, sigmoidoscopy or colonoscopy (SoC), and fecal occult blood test (FOBT) were generated from the BRFSS-based MO County Level Study conducted in 2003, 2007, and 2011. County-specific crude incidence and mortality from 2004 to 2013 were calculated. Pearson's correlation (r) and Poisson regression were used to test associations between cancer rate and screening prevalence. We adjusted regression for county-level mean age, % whites, % low income, % < high school, % no insurance, and % difficulties accessing care.

Results: BC screenings and early stage incidence (all $r \geq .3$, all $p < .005$) were positively correlated. "Ever had CBE" was negatively correlated with BC mortality ($r = -.29$, $p = .002$). For CC, "ever had pap test" was positively correlated with early stage incidence ($r = .28$, $p = .003$). Both "ever had" CRC screenings were correlated with lower mortality ($r = -.19$, $p = .04$ and $r = -.38$, $p < .0001$, respectively). In the adjusted models, "had CBE or mammography in 2 years" was related to higher early stage incidence (Incidence rate ratio [IRR] = 1.01, $p = .03$ and 1.01, $P = .01$, respectively). Also, "ever had CBE" was related to lower mortality (mortality rate ratio = .97, $p = .0007$). "Ever had pap test" was related to higher CC early stage incidence (IRR = 1.07, $p = .01$). Additionally, "ever had SoC" was negatively related to CRC mortality (MRR = .99, $p = .01$).

Conclusions: The study provides ecological evidence of the effectiveness of screenings, particularly CBE, mammography or Pap test in detecting early stage incidence, and CBE or SoC in reducing mortality. Further promotion on screenings is suggested.

P-48

INCREASED INCIDENCE TRENDS OF COLORECTAL CANCER AMONG PATIENTS YOUNGER THAN 50 YEARS BY RACE/ETHNICITY, AGE, AND STAGE AT DIAGNOSIS IN CALIFORNIA, 1990-2013

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Background/Purpose: There has been increasing attention on colorectal cancer (CRC) incidence among patients younger than 50 years at diagnosis with implications for revisiting screening guidelines in the U.S. Using California Cancer Registry (CCR) data, we investigate CRC incidence trends by race/ethnicity, age, sex, and tumor stage.

Methods: CRC diagnoses from 1990-2013 were obtained from the CCR. Incidence rates, annual percent change (APC), and trend analyses were estimated using SEER*Stat software and Joinpoint analysis, by age at diagnosis (<50, 50-74 and 75+ years), sex, stage at diagnosis (*in situ*/localized = early stages, regional/distant = advanced stages), and race/ethnicity (non-Hispanic whites [NHW], non-Hispanic blacks [NHB], Hispanics, Filipinos, Koreans, Japanese, Chinese, Vietnamese, South Asians, and Southeast Asians).

Findings: Of 310,882 incident cases, 9% were younger than 50 years at diagnosis. Across racial/ethnic groups, the proportion of cases diagnosed at younger age was lowest for NHWs and Japanese (7%) and highest for Southeast Asians (22%). The percentage of patients diagnosed at advanced stages varied from 58% for South Asians to 82% for Southeast Asians. While the overall CRC incidence decreased during 1990-2013 for most groups, incidence increased significantly among cases diagnosed at <50 years of age for the following groups: NHWs, male/all stages APC=1.9 (1.5-2.3), female/all stages APC=2.4 (2.0-2.8); Hispanics, male/all stages APC=2.2 (1.6-2.7), female/all stages APC=1.5 (1.0-2.0); and Vietnamese females, advanced stages, APC 2.8% (0.5-5.2). Time-period-specific changes in trends within 1990-2013 varied across racial/ethnic groups.

Conclusion: Cancer registry data used to identify significant increasing CRC incidence among patients younger than 50 years support previous reports in the U.S. This may have implications for targeted screening efforts among specific populations at a younger age than current screening guidelines recommend.

P-49

THE RELATIONSHIP OF MYELODYSPLASTIC SYNDROME (MDS) AND CHRONIC LYMPHOCYTIC LEUKEMIA (CLL) TO OTHER HEMATOPOIETIC CANCERS IN MASSACHUSETTS, 1995-2014R Knowlton¹, S Gershman¹¹Massachusetts Cancer Registry, Boston, MA, United States

Background/Objectives: To examine the relationship of MDS and CLL cases diagnosed in MA from 1995-2010 to other hematopoietic cancers diagnosed subsequently, previously, or simultaneously from 1995-2014. MDS and CLL and their potential to progress to more acute leukemias and lymphomas have not to date been studied in the MCR.

Methods: For both CLL and MDS, two files were created, one consisting of MDS or CLL cases and the other consisting of all other hematopoietic cancers diagnosed 1995-2014. These files were matched, one each with CLL cases and other hematopoietic cancers and with MDS cases and other hematopoietic cancers. Progression of either MDS or CLL before or after another hematopoietic cancer or simultaneous diagnoses was determined.

Results: There were 64,929 cases of hematopoietic cancers diagnosed from 1995-2014. Of these, there were 2,507 cases of MDS and 4,113 cases of CLL diagnosed from 1995-2010. Of the CLL cases, 122 (3%) had a diagnosis of another hematopoietic cancer, 91 were subsequent to the CLL diagnosis, 23 preceded the diagnosis, and 8 were diagnosed simultaneously. Of the 91 subsequent diagnoses, the most common cancers were large cell lymphoma (LCL) (23%), MDS (9%), mantle cell lymphoma (7%), and acute leukemia (7%). Of the MDS cases, 143 (5%) had another hematopoietic cancer diagnosis, 58 subsequent, 79 previous, and 6 simultaneous. Acute leukemia (48%) and LCL (17%) were the most common subsequent cancers while LCL (26%) and Hodgkin lymphoma (11%) were the most common previous cancers.

Conclusions: Although a small percentage of MDS and CLL cases were associated with other hematopoietic cancers, the types of other cancers associated with them are of interest. Subsequent hematopoietic cancers may be related to the treatment of the initial cancer, such as LCL and Hodgkin lymphoma for MDS cases or may be the result of the cancer itself, such as MDS progressing to acute leukemia or CLL progressing to LCL.

P-50

TRENDS IN PROSTATE CANCER INCIDENCE IN NEW JERSEY MEN BY RACE/ETHNICITY, AGE GROUP AND STAGE AT DIAGNOSIS AFTER CHANGES IN PROSTATE SPECIFIC ANTIGEN SCREENING RECOMMENDATIONS, 1990-2014K Pawlish¹, J Li¹, S Vasanthan², L Paddock^{2,3}, A Stroup^{2,3}¹New Jersey Department of Health, Trenton, NJ, United²States; ³Rutgers Cancer Institute of New Jersey, New Brunswick, NJ, United States; ³Rutgers School of Public Health, Piscataway, NJ, United States

Background: Prostate cancer incidence in New Jersey decreased by 19% in 2012, after changes in prostate-specific antigen screening recommendations.

Purpose: To characterize changes in prostate cancer incidence in New Jersey.

Methods: We analyzed data from the NJ State Cancer Registry to calculate age-adjusted prostate cancer incidence rates using SEER*Stat and estimated annual percent changes and changes in time trends by race/ethnicity, age group, and stage at diagnosis using Joinpoint regression.

Results: Prostate cancer incidence trends changed significantly among NJ men ($p < 0.05$), with an increase of 20.7% per year from 1990-1992, followed by decreases of 1.6% per year from 1992-2011 and 11.8% from 2011-2014. A similar change in trends in prostate cancer incidence in 2011 was observed in non-Hispanic white and black men, but not in Asian or Pacific Islander (API) or Hispanic men. We observed a 3.8% increase in prostate cancer incidence from 1990-2001 and a 5.5% decrease during 2001-2014 in API men and a 2.7% increase from 1990-2002 and a 5.2% decrease from 2002-2014 in Hispanic men. A change in trend with a larger decrease in incidence after 2011 was observed in NJ men aged 40-49 and 70-79 years, while prostate cancer started to decline earlier in men aged 50-59, 60-69, and 80+ years. The decrease in prostate cancer incidence in 2011 in NJ men was mainly due to a change in trend in local stage prostate cancer, with a 13.3% decrease per year from 2011-2014. The incidence of distant stage prostate cancer was stable during the last 12 years, with a 9.1% decrease per year from 1990-92, 20% decrease from 1992-95, 6.4% decrease from 1995-2003, and a 0.2% increase from 2003-2014.

Conclusion: Trends in prostate cancer in NJ changed significantly in 2011, with an 11.8% decrease per year. Prostate cancer is the most common cancer in NJ men, and it is important to monitor any changes in incidence of distant stage prostate cancer, as well as prostate cancer mortality.

P-51

COLORECTAL CANCER INCIDENCE DECLINING IN NEW JERSEY

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Background: During 2013, colorectal cancer was the third most common cancer diagnosed among New Jersey (NJ) men and women. In the United States (US), tremendous progress has been made over the last decade to reduce the burden of colorectal cancer which has largely been attributed to the prevention and early detection of colorectal cancer through screening.

Purpose: To examine trends in colorectal cancer incidence in NJ.

Methods: The NJ State Cancer Registry was used to identify colorectal cancer cases aged 20 years and older from diagnosis years 2004-2013. Rates calculated are per 100,000 and age-adjusted to the 2000 U.S. population standard. Annual percent changes (APCs) were calculated using weighted least squares method. The APC is statistically significantly different from zero ($p < 0.05$). Statistics calculated using Surveillance Research Program, National Cancer Institute SEER*Stat software version 8.3.2.

Results: From 2011-2013, NJ counties had age-adjusted colorectal cancer incidence rates ranging from 43.5 to 80.0 per 100,000 men and women. From 2004-2013, all counties in NJ showed a decline in colorectal cancer incidence rates; 15 out of 21 counties showed a statistically significant decline. The U.S. Preventive Services Task Force recommends colorectal cancer screening beginning at age 50 years. About 90% of cases were age 50 years and older at diagnosis. We saw similar patterns when the analysis was restricted to adults age 50 years and older.

Conclusion: Colorectal cancer incidence rates in NJ have declined during the last decade; however, the burden of disease varies geographically. As a next step, analysis could be performed to examine county-level screening rates and colorectal cancer incidence by stage. Higher screening could result in lower colorectal cancer incidence by the detection and removal of polyps. Higher screening could also result in a higher proportion of colorectal cancers diagnosed at early stage.

P-52

HOT-SPOTTING PREVENTABLE CANCERS: DONE RIGHT

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Background: Hotspotting identifies high-risk areas to target for cancer screening. The traditional method of hotspotting uses age-adjusted mortality rates obtained through direct standardization. We developed a method to identify hotspots that incorporates the underlying population risk into mortality-to-incidence ratio (MIR) for the cancer.

Purpose: This study found colorectal cancer hotspots in Arkansas (AR) by our method and compared our results to traditional methods.

Methods: Standardized mortality (SMR) and incidence (SIR) ratios adjusted for age, gender, race, and year were computed for colorectal cancer in AR counties during 2009-2013. SIR for early diagnosis (SEER summary stage: localized) identified counties with low percent of early diagnoses. Indirect standardization was used instead of comparing to a standard age-specific population for the nation. Quartiles of MIR classified counties with high, mid (interquartile range) and low MIRs.

Results: AR counties with high MIRs (upper quartile: ≥ 1.26) have relatively high mortality and low early stage incidence. 17 of these 19 counties grouped into 3 contiguous regions, considered hot spots. One hotspot (8 counties in the delta) is contained within traditionally identified counties (Siegel, R.L., et al. *Cancer Epidemiol Biomarkers* 24.8 (2015):1151-6.). Other hotspots, 5 counties in Northeast AR and 6 counties in West-Central AR were not previously identified. There was discordance in the counties identified with our methodology compared to the traditional methodology. While 8 counties were identified as hotspots by both methods, our method identified 9 new counties in 2 hotspots.

Conclusions: Screening for preventable cancers remains low. Utilizing our method to identify hotspots could pave a new way in cancer screening, especially in reaching "hard-to-reach" populations. We plan to replicate the methodology on breast and cervical cancer to identify the hotspots.

P-54

CANCERS WITH INCREASING TRENDS RELATED TO OBESITY AND LOW PHYSICAL ACTIVITY IN NEW JERSEY: VARIATIONS BY COUNTYP Agovino¹, L Paddock^{1,2}, A Stroup^{1,2}¹New Jersey Department of Health, NJ, United States; ²Rutgers Cancer Institute of New Jersey/Rutgers School of Public Health, NJ, United States

Background: Being obese/overweight and lack of physical activity are major risk factors for several cancer types.¹ The cancers presented in this analysis were selected because they have demonstrated increasing incidence trends since 1990 in New Jersey and have significant risk factors of obesity and low physical activity.

Purpose: To display on a map the recent incidence (2009-2014) and the long-term trends (1990-2014) for endometrial, kidney, and pancreatic cancers by New Jersey county. County-level obesity and leisure time activity prevalence (2009-2013) are also presented by NJ county to highlight the need for prevention programs.

Methodology: Data were obtained from the New Jersey State Cancer Registry (NJSCR). SeerStat was used to generate age-adjusted incidence rates (2009-2013) and Annual Percent Change (APC) with a test for statistical significance at the 95% confidence limit. Obesity and leisure time activity data were provided by the Centers for Disease Control and Prevention, County Data Indicators. ArcMap was used to generate cancer maps by New Jersey county to display incidence rates and statistically significantly increasing APC.

Results and Conclusions: New Jersey has seen statistically significant increases in endometrial (APC, 0.80, p-value < 0.05), kidney (APC, 1.51, p-value < 0.05), and pancreatic (APC, 0.52, p-value < 0.05) cancer rates from 1990 to 2013. The most striking increase was seen for kidney cancer, which significantly increased for 15 out of 21 New Jersey counties. Recent kidney cancer incidence rates are highest in the New Jersey's Southern counties. Significantly increasing trends for endometrial and pancreatic cancer varied by New Jersey county as well.

Reference:

1. World Cancer Research Fund and American Institute for Cancer Research. Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Perspective. Washington, DC., 2007.

P-55

MAPPING ALASKA STOMACH CANCER INCIDENCE RELATIVE TO THE GEOGRAPHIC DISTRIBUTION OF RACES IN THE STATEWIDE POPULATIOND O'Brien¹¹Alaska Cancer Registry, Anchorage, AK, United States

Stomach cancer incidence nationwide is relatively low, with an average age-adjusted rate of 6.2 cases per 100,000 persons for diagnosis years 1999-2013. Alaska's overall stomach cancer rate is 8.1 for diagnosis years 1996-2013 and is ranked ninth highest nationally by state. Within Alaska, stomach cancer is strongly stratified by race, with the highest rates associated with Alaska Natives. Rates for whites are 5.0, blacks 10.1, Asian and Pacific Islanders 13.8, and Alaska Natives 22.6. Rates are also highly stratified by gender, with male rates being about twice as high as females.

A choropleth map of Alaska showing cancer incidence rate by public health region for cases diagnosed 1996-2013 shows most regions have a relatively low rate. The notable exceptions are the Southwestern and Northern regions, with rates of 20.0 and 29.4, respectively. This is many times the rate of the remaining regions, with an average rate of 6.5. This rate disparity by geography can be attributed to the statewide population distribution of races. The regions with the highest stomach cancer rates are also those with the highest proportions of Alaska Native residents. The populations of the Northern and Southwestern regions are about 70% Alaska Native. In the other regions, the Alaska Native populations are under 20%, with the smallest percentage in Anchorage/Mat-Su at 9%.

Rates for whites are relatively low throughout the state, ranging from 3.9 to 5.3. Rates for Alaska Natives are significantly higher than for whites. However, there is a large difference in rates for Alaska Natives by geography. Rates are lowest in Southeast (12.7) and Interior (15.2), and highest in the Southwest (25.8) and Northern (39.8) regions.

The geographic rate disparity for Alaska Natives may be due to several factors:

- *H. pylori* bacterial infection (75% prevalence has been reported in Alaska Natives)
- Preservation of traditional foods by smoking and salting
- High tobacco use by the Alaska Native population

P-56

ASSESSING COLONOSCOPY PREVALENCE IN ARKANSAS USING SMALL AREA METHODS

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Background: In 2014, Arkansas (AR) ranked 45th in the U.S. for adults age 50 and over who had recent colorectal endoscopy screenings, and ranked 19th for 2009-2013 colorectal cancer (CRC) incidence. Socioeconomic status and race may be associated with colonoscopy prevalence and colonoscopy prevalence may be associated with early-stage CRC incidence.

Purpose: This study estimated colonoscopy prevalence and early-stage CRC incidence for AR census tracts during the period 2010-2014.

Method: Responses to the Behavioral Risk Factor Surveillance System for years 1999, 2002, 2004, 2006, 2008, 2010, 2012, and 2014 were obtained. Colonoscopy prevalence in AR was estimated by race (black or white), sex and income status (above/below \$15K) for the population, ages 50-79. Early-stage (SEER summary stage 1) CRC were obtained from AR Central Cancer Registry and categorized similarly. Small area estimation methods were used to estimate colonoscopy prevalence and early-stage CRC incidence in census tracts during the period, 2010-14.

Results: Black females of both low and high income, and white males and females of high income had an increase in colonoscopy prevalence from 1999 to 2014. The 2012 AR estimates of colonoscopy prevalence were highest for white females, high income at 0.648, and lowest for black males, low income at 0.371. Rural regions had lower rates of early-stage CRC and colonoscopy.

Conclusion: Socioeconomic status plays a role in both colonoscopy prevalence and CRC incidence. Higher income individuals had higher prevalence in 2012 and a significant increase from 1999 to 2014. Counties bordering the Mississippi River tended to have lower colonoscopy prevalence in 2012, which could be the result of socioeconomic status or race. The overall prevalence of Arkansans between 50 and 79 was around 0.6 in 2012, lower than the goal of 0.8 by 2018.

P-57

VARIATION IN ROUTES TO DIAGNOSIS BY SEX, AGE AND DEPRIVATION ACROSS NINE YEARS

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Background: Cancer survival in England is still lower than the European average, which has been partly attributed to later stage at diagnosis. Efforts to diagnose cancer earlier include improving diagnostic pathways, with fewer cancers diagnosed as an emergency presentation (EP) and more through managed pathways such as Two Week Wait (TWW) referral. These changes can be monitored using the Routes to Diagnosis dataset, allowing us to assess the impact of early diagnosis initiatives and where best to focus future efforts.

Method: Administrative hospital patient episode's data are combined with Cancer Waiting Times, cancer screening, and cancer registration data. The method uses the diagnosis date as an endpoint and then works backwards to identify the likely referral route. Time trends by route between 2006 and 2014 for 56 cancer sites are examined for the difference and significance of any proportional changes in incidence.

Results: The proportion of all cancers diagnosed via an EP fell from 24% in 2006 to 20% in 2013. The proportion of all cancers diagnosed via TWW increased from 25% to 34%. Males and females show similar changes over time for all cancers aggregated. EPs in those aged 85 and over fell from 43% to 40%; compared to a 1% drop in those aged under 50. An increase in TWW diagnoses is also seen for the over 85s (18% to 28%) as well as in other age bands. All deprivation quintiles show an increase in TWW diagnoses over time, with a larger reduction in EP in the most deprived quintile (30% to 25%) group. These trends will include 2014 once the current data are refreshed.

Conclusions: The changes seen in Routes to Diagnosis show a reduction in the proportion of EPs and an increase the use of other referral pathways, TWW in particular, with associated higher survival. There are still gaps between younger and older, and affluent and deprived patients. Early diagnosis initiatives may help play a part in changing these routes.

P-58

AGE-PERIOD-COHORT ANALYSIS OF MELANOMA, LEUKEMIA AND THYROID CANCER IN ONTARIO, CANADAY Wang¹, D Nishri¹¹Cancer Care Ontario, Toronto Ontario, Canada

Background: Age-period-cohort (APC) analysis was used to discern three types of time varying phenomena: age, period, and cohort effects. We want to check three cancers' model fitting by APC analysis as well as to highlight our secondary purpose of interpreting the parameter estimates.

Purpose: To examine the changing patterns of female thyroid, female melanoma and male leukemia incidence in Ontario, Canada from 1983 to 2012. To explore the relationship between these cancers' incidence rates and three time varying effects: age, period and cohort; and to report the best model results from age-period-cohort analyses of these cancers.

Methods: Using cancer incidence data for 1983 to 2012 from the Ontario Cancer Registry, the *apc* package in R software was applied to sequentially fit age-period-cohort (APC) models for female thyroid cancer, female melanoma, and male leukemia. Descriptive plots of the observed data, deviance tables, and over-dispersion tests were reported. As well, the parameter estimates for the age, period and cohort effects were graphed, the best fitting model was reported and the possible explanations for the observed patterns were explored.

Results: The full APC model gave the best fit for female thyroid cancer and female melanoma, while the age-period (AP) model gave the best fit for male leukemia. No over-dispersion was detected. Each cancer model had a different starting age and a different pattern for age at diagnosis. The cohort patterns also differed between female melanoma and thyroid cancer. While significant non-linear period effects were detected for all three cancers, they were most striking for female thyroid cancer.

Conclusions: A careful examination of incidence patterns through the fitting of age-period-cohort models can lead to a deeper understanding of the factors that have influenced past trends, and provide a foundation for the projection of future cancer burden.

P-59

RACIAL AND ETHNIC DIFFERENCES IN BREAST CANCER INCIDENCE IN YOUNG WOMEN BY AGE AND BREAST CANCER SUBTYPEM Shoemaker¹, M White¹, M Wu¹, H Weir¹, I Romieu^{2,3,4}

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Black women are diagnosed more often with breast cancer at younger ages and with aggressive subtype triple negative (TN). We examined recent patterns in breast cancer incidence in young women, ages 20-49, to provide a comprehensive description of racial/ethnic differences.

Using combined NPCR/SEER data from 2004-2013, we analyzed invasive breast cancer incidence in young women by age, race/ethnicity, stage and grade. To analyze by tumor subtype, cases from 2011-2013 were included; a high percentage of data were missing on estrogen receptor (ER), progesterone receptor (PR), and human growth factor-neu receptor (HER2) status in prior years. ER and PR status were combined into one hormone receptor (HR) status. Four HR/HER2 subtypes were created: HR+/HER2+, HR-/HER2+, HR+/HER2-, and HR-/HER2- (TN). HR+ included cases with ER+, PR+, or borderline ER or PR and HR- included cases with ER- and PR-. Cases with borderline HER2 were excluded.

Young black women had significantly higher breast cancer incidence than other racial/ethnic groups. The gap in incidence between black women and white women decreased with age until ages 45-49, when incidence rates in white women surpassed those in black women (193 per 100,000 vs. 183 per 100,000, <0.05). Black and Hispanic women had higher proportions of advanced stage and high grade cases than white and Asian or Pacific Islander women. Rates of TN breast cancer were highest in black women, and this difference increased with age. Black women ages 45-49 had more than twice the incidence of TN breast cancer than any other race/ethnicity (<0.05).

Compared to other women, young black women with breast cancer are more likely to be diagnosed before age 45, with a more aggressive subtype, at advanced stages and higher grades, and thus are at greater risk of poorer breast cancer outcomes. This study can help inform breast cancer risk reduction and prevention efforts targeting young black women.

P-60

CHARACTERIZATION OF SECOND PRIMARY MALIGNANCIES IN OHIO

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Improved early detection, treatment, and supportive care have resulted in a growing number of cancer survivors in the United States. Multiple primaries, defined as two or more independent primary malignancies in an individual, are a growing area of interest for the cancer survivorship population. It is estimated that approximately 16% of the new cases reported to the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) Program are a second or higher order malignancy.

The goal of this study was to characterize the incident cases of second primary malignancies in Ohio that were reported to the Ohio Department of Health's Ohio Cancer Incidence Surveillance System (OCISS) from 1996-2013. Analyses showed that, of the 1,128,717 *in situ*/malignant cases reported to OCISS, 8% were the first of multiple primaries and 15% were a second or higher order malignancy. From 1996-2008 (allowing time to be diagnosed with a second primary cancer), larynx (21.7%), bladder (20.9%), melanoma of the skin, (17.7%) and oral cavity and pharynx (16.5%) were the sites with the highest percentages of multiple primaries. The most common second primary cancer site diagnosed, regardless of first primary cancer site, was lung and bronchus. Additional factors examined included the time between the first and second primary cancer, variation according to demographic characteristics (age, sex, race), stage at diagnosis and groups of cancer sites/types characterized by common causal factors, such as tobacco-related and HPV-related sites/types (in an effort to determine whether first and second primary cancers occur around constellations of similar causal factors).

To our knowledge, this is the first time second primaries have been characterized in Ohio. These results may provide direction to researchers in cancer survivorship; moreover, this work may be used to inform healthcare providers of specific cancer sites/types that should be monitored in cancer survivors.

P-61

TIME BETWEEN BREAST CANCER DIAGNOSIS AND TREATMENT AMONG ALASKA NATIVE PEOPLE

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Background: Short time between cancer screening, diagnosis, and onset of treatment has been linked to increased quality of care as well as improved survival. The National Breast Cervical Cancer Early Detection Program (NBCCEDP) benchmark guideline for treatment service delivery is ≤ 60 days from diagnosis to treatment. Yet, disparities in access and time to diagnosis and treatment have been documented in the U.S., including among American Indian/Alaska Native populations.

Objective: To examine the time from breast cancer diagnosis to initiation of treatment among Alaska Native (AN) women, and evaluate the impact of age at diagnosis, stage at diagnosis, and rural/urban residence.

Methods: This study analyzed data from the SEER Alaska Native Tumor Registry (ANTR) for women who received a first diagnosis of breast cancer between 2009-2013, and who received cancer treatment at Alaska Native Medical Center (ANMC). Associations of demographic and clinical characteristics with whether guideline-appropriate treatment was received (yes/no) was evaluated using logistic regression.

Results: During the period 2009-2013, 345 AN women were diagnosed with invasive breast cancer. Mean age of diagnosis was 56.8 years (SD = 13.0). The median time from diagnosis to initiation of treatment was 23 days ($P < .05$) with almost all women (94.6%, $n = 263$) meeting the ≤ 60 day guideline target. No significant differences in time from diagnosis to first treatment were found by age, urban/rural residence, stage at diagnosis, or type of treatment.

Conclusion: These findings indicate that most AN women diagnosed with breast cancer within the Alaska Tribal Health System receive timely treatment after diagnosis according to NBCCEDP recommendations, and that time to treatment did not differ by rural/urban residence, age, or stage at cancer diagnosis. Future research should evaluate time from screening mammography to cancer diagnosis.

P-62

RECENT TRENDS AND PATTERNS IN DIAGNOSIS AND SURVIVAL OF PROSTATE CANCER BY RACE/ETHNICITY IN CALIFORNIAL Liu¹, A Sipin¹, J Zhang¹, D Deapen¹¹Los Angeles Cancer Surveillance Program, Los Angeles, CA, United States

Background: Concerns for over-screening and over-diagnosis of prostate cancer by the use of prostate-specific antigen (PSA) test led to the 2008 US Preventive Service Task Force (USPSTF) recommendation against PSA screening men over 75 years of age. In 2012 USPSTF recommended against PSA-based screening for prostate cancer in all age groups. In the following years, studies have reported significant decreases in prostate biopsy and treatment, early stage prostate cancer incidence rates, and rise in late stage incidence rates.

Purpose: To evaluate the most up-to-date race/ethnicity-specific and age-specific patterns and trends in prostate cancer incidence, mortality, survival, and associated tumor/clinical characteristics in different populations, following the USPSTF recommendation.

Methods/Approach: Using the California Cancer Registry (CCR) and the CDC WONDER databases, we will examine the time trends of age-adjusted and age-specific prostate cancer incidence and mortality rates by race/ethnicity and stage at diagnosis. We will also look into the use of PSA test and other tumor/clinical characteristics over time as recorded by the CCR.

Results: The most current available results will be presented.

Conclusions/Implications: Findings from our study will provide important population-based information for evaluating the impact of USPSTF recommendation against PSA screening on prostate cancer outcomes in different racial/ethnic populations.

P-63

ASSOCIATION OF THE PUERTO RICO TOBACCO CONTROL POLICIES AND THE DECREASING TREND IN LUNG AND BRONCHUS CANCER MORTALITYM Alvarado¹¹Puerto Rico Central Cancer Registry, Comprehensive Cancer Center, University of Puerto Rico, San Juan, Puerto Rico

Background: In Puerto Rico (PR), lung and bronchus cancer (LBCA) mortality has been decreasing by approximately 2.1% per year since 1993. Although PR is one of the jurisdictions in the U.S. with the most restrictive and comprehensive legislations in tobacco control, data from the BRFSS shows that the prevalence of tobacco use has only changed less than 1% in the last 3 years.

Purpose: To determine the relationship between tobacco control programs and the LBCA mortality in PR.

Methods: The study population was obtained from the Demographic Registry of PR. An Age-Period-Cohort (APC) analysis was performed for the period 1980-2014 among the population over 29 years old to determine the birth cohort effects of the tobacco control policies in the decreasing trend of LBCA mortality.

Results: A total of 18,760 LBCA-related deaths occurred in PR during 1980-2014. The mortality for LBCA significantly decreased 2.1% (95% CI: -2.6, -1.7) per year from 1993-2014 among men. However, a smaller decrease in women occurred later in 1996, 1.6% (95% CI: -2.3, -0.8). The APC analysis showed that birth cohorts born after 1940 had a reduced LBCA mortality risk when compared with those born before 1940. A steady increase in the 1980 birth cohort was observed, suggesting a higher risk for LBCA mortality among birth cohorts born after 1980 (youngest population). Period relative risks effect generally declined over the entire study period being 2002 the year with the most notable decline.

Conclusions: The continuous decrease in the mortality of LBCA since 1993 is consistent with the years when tobacco control policies were implemented in PR (1990's). Future studies should emphasize the analysis of the increasing mortality trend in the birth cohort of 1980 and the high prevalence of smoking among the youngest, poor, less educated, and LGBT population.

P-64

WORLDWIDE INCIDENCE OF HEPATOCELLULAR CARCINOMA: A 10-YEAR FORECAST

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Background: Hepatocellular carcinoma (HCC) is the third leading cause of cancer deaths worldwide with the incidence growing due to an increase in associated risk factors.

Purpose: To estimate the change in HCC incidence over the next 10 years due to the change in HCC risk factors worldwide.

Methods: To estimate the incidence of HCC, we obtained data reported by the International Agency for Research on Cancer (IARC) on the incidence of liver cancer (ICD-10 code C22) from country-specific cancer registries, and country-specific histological data on the proportion of liver cancer cases comprised of HCC (ICD-10 histology codes 8170-8175). We identified hepatitis B virus, hepatitis C virus, alcohol abuse, and obesity as the main risk factors associated with HCC and developed an incidence forecast model of HCC that incorporates the effect of changes in exposure to each of these risk factors.

Results: In 2016, the incidence of HCC ranged from 2 per 100,000 in Latin America to 27 per 100,000 in high-income Asian countries. Over the next 10 years, we expect an approximately 30% increase in HCC cases in most regions of the world due to HCC risk factors, population growth, and aging.

Conclusions: The incidence of HCC will continue to increase over the next 10 years due to an increase in risk factors and demographic changes. Further analyses will estimate the increase in HCC incidence that is attributable to each risk factor.

P-65

HPV-ASSOCIATED CANCER INCIDENCE, UNITED STATES 2009–2013

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Background: Human papillomavirus (HPV) causes some cervical vulvar, vaginal, penile, anal, rectal, and oropharyngeal cancers. While most cervical cancers are preventable with regular screening, other HPV-associated cancers do not have effective population-based screening strategies. HPV vaccination can prevent cervical cancer, and perhaps other HPV-associated cancers.

Purpose: To describe the current burden of HPV-associated cancers.

Methods: We analyzed data from cancer registries participating in CDC's National Program of Cancer Registries and NCI's Surveillance, Epidemiology, and End Results program that met criteria for high data quality for 2009–2013, covering 99% of the U.S. population. We defined HPV-associated cancers as histologically confirmed invasive cancers at anatomic sites with cell types in which HPV DNA frequently is found (all carcinomas of the cervix, including adenocarcinomas and squamous cell cancers [SCC]; SCCs only for vulva, vagina, penis, anus, rectum, and oropharynx). For each cancer type, we calculated HPV-attributable cancers by multiplying the number of cancers by the percentage attributable to HPV based on genotyping studies.

Results: An average of 39,844 HPV-associated cancers (11.7 per 100,000 persons) were diagnosed annually, including 23,330 among females (13.5 per 100,000) and 16,514 among males (9.9 per 100,000). The most common cancers were cervical carcinomas (11,693 cases; 7.2 per 100,000 females) and oropharyngeal SCCs (13,276 cases among males and 3,203 among females; 4.6 per 100,000 persons). 31,500 HPV-associated cancers (79%) were estimated to be attributable to HPV. Of these, 29,100 were attributable to HPV types which can be prevented by the 9-valent HPV vaccine.

Conclusions: HPV-associated cancer incidence—and the impact of primary and secondary interventions to prevent these cancers—can be monitored using surveillance data from population-based cancer registries. Data are available at <https://www.cdc.gov/cancer/hpv>.

P-66

THE BURDEN OF RARE CANCERS IN THE UNITED STATES**C DeSantis¹, A Jemal¹**¹American Cancer Society, Inc., Atlanta, GA, United States

There are limited data available on the burden of rare cancers in the United States. Using data from the North American Association of Central Cancer Registries and the Surveillance, Epidemiologic and End Results program, we provide information on incidence rates, stage at diagnosis, and survival for more than 100 rare cancers in the U.S. We define rare cancers as those with that are diagnosed in fewer than 6 persons per 100,000 per year.

Overall, approximately 20% of cancer patients in the U.S. are diagnosed with a rare cancer. Rare cancers make up a larger proportion of cancers diagnosed in Hispanic (26%) and Asians/Pacific Islander (25%) cancer patients compared to non-Hispanic (NH) black (21%) and NH white (19%) cancer patients. More than two-thirds (68%) of child and adolescent cancer patients are diagnosed with a rare cancer, whereas rare cancers comprise less than 20% of cancers diagnosed in patients ages 65 and older.

Five-year relative survival is poorer for patients with a rare cancer compared to those diagnosed with a more common cancer among both males (48% versus 75%) and females (55% versus 74%). The survival difference in part reflects differences in stage at diagnosis; 53% of rare cancers are diagnosed at regional or distant stages compared to 43% of common cancers. However, five-year relative survival is substantially higher for children and adolescents diagnosed with a rare cancer (78%) than for adults (39% for adults ages 65-79).

Continued efforts are needed to diagnose rare cancers earlier and improve survival. Discoveries for rare cancers can further knowledge for all cancers.

P-67

UTILIZATION OF PROTON BEAM THERAPY: A POPULATION-BASED ASSESSMENT OF CALIFORNIA, 1988-2014**A Parikh-Patel¹, C Morris¹, K Kizer¹**¹Institute for Population Health Improvement, University of California, Davis, Sacramento, CA, United States

Background: Proton beam therapy (PBT) has been available since the late 1980s. This type of radiation treatment (RT) has been advocated for various types of cancer because it causes less collateral tissue damage; however, high costs and limited availability have constrained its utilization. This study sought to examine trends in and determinants of PBT use in California, as existing studies on this topic are few.

Methods: Persons diagnosed with all cancer types from 1988-2014 who had any type of RT as their first course of treatment were identified in the California Cancer Registry. Cross tabulations were performed to summarize the demographic characteristics of the study population across two major categories: (1) individuals who received PBT, and (2) those who received all other types of RT. Trends in the use of PBT were assessed. Multivariate logistic regression models assessed the independent effects of age, race, socioeconomic status, and health insurance type on receipt of PBT relative to other forms of RT.

Results: A total of 4,366,752 people were diagnosed with cancer in California during the study period; 1,009,204 (23%) received some type of RT and 7,656 received PBT (0.76%). PBT was most often used to treat cancers of the prostate (43%), breast (13.9%), eye (11.6%), lung (6%), and brain (5.5%). PBT use peaked in 2003-2004, but declined to an average of 540 patients per year from 2005-2014. No significant differences in receipt of PBT were seen by age group, race, or SES. Among patients treated with any type of radiation, nearly 5% of individuals with Medicare health insurance received PBT, compared with 0.7% and 0.9%, respectively, of those having Medicaid or private health insurance.

Conclusions: There are significant differences in PBT use by health insurance type. Further analysis will be conducted to simultaneously adjust for additional demographic factors and to assess geographic variations in receipt of PBT. Results and implications will be presented.

P-68

PERSONALIZED ESTIMATES OF PROSTATE CANCER OVERDIAGNOSIS: MODEL PREDICTIONS USING REGISTRY DATA ON INCIDENCE RATES AND LIFE EXPECTANCY

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Background: The chance that a screen-detected prostate cancer is overdiagnosed (i.e., would not have surfaced in the absence of screening) depends on the aggressiveness of the cancer and competing mortality risk. The dependence of the risk of overdiagnosis on tumor features and life expectancy is understudied.

Methods: A microsimulation model estimated prostate cancer development and progression using incidence rates from the Surveillance, Epidemiology, and End Results (SEER) registries and historical prostate-specific antigen (PSA) testing rates. The model simulated life histories, including diagnosis with and without screening, for asymptomatic men screened at ages 66–74 years, and competing death was derived using SEER-Medicare claims data given no, mild, moderate, or severe comorbidities at diagnosis. An indicator of whether diagnosis without screening preceded competing death was regressed on PSA level (range 4–10 ng/mL), tumor grade (Gleason sum 2–6, 7, or 8–10) and stage (T-stage $\leq$ T2B or $>$ T2B), and patient age and comorbidity level. The fitted regression model predicted probabilities of overdiagnosis given the patient and tumor features.

Results: Simulated life histories under historical testing rates reproduce SEER incidence rates by age, stage, and grade. A regression model fit only to PSA and tumor grade and stage predicted overdiagnosis with an area under the curve (AUC) of 0.58. Including age increased the AUC to 0.61 and including comorbidity further increased the AUC to 0.64. Estimated probabilities of overdiagnosis ranged from 15 to 80%, significantly decreasing with PSA level and tumor grade and significantly increasing with age and comorbidity level.

Conclusions: Incidence rates and life expectancy data from cancer registries permit modeling prostate cancer progression and competing mortality. Model predictions can inform patients and physicians about the potential futility of treating low-risk tumors, especially in older, less healthy men.

P-69

VALIDATE THE NEED FOR PROCURING POTENTIALLY LIFE SAVING STATEWIDE ALERT SYSTEMS FOR VARIOUS CANCER MISDIAGNOSES

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Background: A research study conducted by Chamie et al. for non-muscle invasive bladder cancer cases diagnosed in 2004-2005 concluded that omission of muscle or its mention in the pathology reports resulted in increased mortality among patients in Los Angeles County. If the percentage of mortality is extrapolated to the statewide data, it is estimated that at least 200-250 lives could be saved every year if actionable alerts could be sent out to the attending physician, surgeon, and pathologist.

Purpose: To determine if development of critical IT infrastructure for creating a statewide alert system should be prioritized over other Registry projects based on the potential to improve patient survival. This is dependent on if the conclusions from Chamie et al. could be validated using the statewide California Cancer Registry data instead of using the smaller Los Angeles County data during the same time period of 2004-2005.

Methods: The data included 8,295 patients who are 20+ years old diagnosed with non-muscle invasive urothelial carcinoma of the bladder. The data from text fields derived from the pathology reports was grouped into three categories based on the presence or absence of the muscle or if the annotated text fields failed to mention the muscle. Chi-squared tests were used to identify correlations between the status of the detrusor muscle being mentioned and other variables. Additional survival analyses were conducted through the use of competing risks regression.

Results: Preliminary results found that even for the statewide data, when the detrusor muscle was not mentioned, bladder cancer mortality was significantly higher than when the detrusor muscle was mentioned. This meant that when the detrusor muscle was mentioned, adequate staging was more likely done, which ultimately increased survival implying that procurement of statewide alert systems for misdiagnoses needs to be a high priority for the cancer registry community.

Research

P-70

USE OF ADJUVANT CHEMOTHERAPY IN PATIENTS WITH STAGE III COLON CANCER IN THE PUERTO RICO HISPANIC POPULATION

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Background: In Puerto Rico (PR) 6,544 persons were diagnosed with colon cancer (CC) and 3,168 persons died from CC in the period 2008-2012, making it one of the leading causes of cancer death. Therefore it is crucial to ensure adherence of the recommended guidelines to improve the overall health outcomes. Evidence indicates that chemotherapy improves the survival among colon cancer patients with node-positive.

Purpose: To examine the factors that affects the use of adjuvant chemotherapy in patients with stage III CC in PR Hispanic Population.

Methods: The study cohort will consist of CC patients with a curative surgery in the PR Central Cancer Registry-Health Insurance Linkage Database between 2008-2012 who fulfilled the American Joint Cancer Committee criteria for stage III and had no insurance coverage gaps during the period. Logistic regression models will be used to estimate the crude and adjusted odds ratio. The likelihood ratio test statistic will be used to assess the significance of interaction terms.

Results: Among patients with stage III CC who received curative surgery, 75% received adjuvant chemotherapy. Receiving chemotherapy varied by diagnosis year ranging from 68.78% to 80.58%. Significant associated factors of receiving chemotherapy within 4 months after resection included having less than 65 years (OR 5.11; 95%CI 3.09-8.45; $p < 0.01$) and being married (OR 1.54; 95% CI 1.04-2.27; $p = 0.03$). Likewise, patients enrolled in Medicare (OR 2.04; 95% CI 1.13-3.68; $p = 0.02$) or Medicaid/Medicare dual eligible (OR 1.75; 95%CI 1.02-2.98; $p = 0.04$) were more likely to receive chemotherapy compared to patients with only Medicaid.

Conclusions: This study helps identify disparities in the quality of cancer care. The use of cancer registry data, particularly when linked to claims data becomes an effective resource for cancer research.

Student

P-15

WHAT ARE THE GEOGRAPHICAL DIFFERENCES AMONG CHILDREN AND ADOLESCENTS WITH BRAIN AND OTHER CNS TUMORS IN CALIFORNIA? DOES ANY CLUSTERING EXIST?

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Background: Understanding spatial phenomena among diseases, including cancer, is important to understand its causes and how to implement prevention and control strategies. Spatial analysis studies on childhood cancer in California, including central nervous system (CNS) tumors, have been scarce.

Methods: This study used all California children (0-14 years old) and adolescents (15-19 years old) diagnosed with a malignant or non-malignant CNS tumor during 2001-2004. SatScan v9.4.4, a spatial, temporal, and space-time scan statistical software package was utilized for two modeling techniques. The two models used were a discrete Poisson model and a space-time permutation (STP) model. Analyses were conducted to look at differences by age, histology, race/ethnicity, socioeconomic status, tumor grade, urbanization, facility type, year of diagnosis, and malignancy status.

Results: From 2001 – 2014 there were a total of 6,387 cases of CNS tumors in CA children and adolescents, 67% malignant and 33% non-malignant. We hope to determine the most likely geographical areas with higher than expected cases of CNS tumors when compared to the population at risk using the Poisson model. Additionally, the STP model will be used to determine the number of CNS tumor cases in a cluster to what would have been expected if the temporal and spatial locations of all cases were independent of each other.

Conclusions: The results from the analyses will attempt to detect potential environmental exposures, clustering, or other geographic patterns of disease. Results from spatial analyses are not only directed towards public health professionals, but can be a widely used resource for researchers, the general public, and policy makers. Due to the vast collection of unknown risk factors in cancer for CNS tumors, continued research at the spatial and environmental level is imperative.

P-25

RACIAL/ETHNIC DIFFERENCES IN THYROID CANCER INCIDENCE IN THE UNITED STATES, 2007-2013

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Background: Small tumor diagnostic tools, ultrasound-guided fine-needle aspiration (US-guided FNA), and computed tomography could be causing thyroid cancer incidence to increase and vary between races/ethnicities due to dissimilar access and overdiagnosis of indolent tumors.

Methods: We investigated thyroid cancer incidence by race/ethnicity (white, Hispanic, Asian, African American, Native American) across patient/tumor characteristics to determine if differences existed and are driven by use of US-guided FNA. Microscopically confirmed malignant thyroid cancer cases in SEER 18 (N=80,297) were used to calculate age-adjusted incidence rates (AAIRs). Multivariate analysis determined the association between race/ethnicity and patient characteristics (tumor sequence, gender, age at diagnosis, insurance coverage, tumor stage at diagnosis, county level education); tumor histology (papillary vs. follicular, medullary, anaplastic); and size at diagnosis (<20 mm vs. >20 mm).

Results: AAIRs increased and varied by races/ethnicities. Odds ratios (OR) were significant for histology, tumor size at diagnosis, tumor stage at diagnosis, and insurance coverage (all $p < .0001$). As we would expect, if US-guided FNA was the cause of variation between races, nonwhites had lower odds of having small tumors <20 mm (OR range=0.67-.78, 95% confidence interval [CI]=0.57-0.84; all $P < .0001$). Unexpectedly, AAIRs increased and significant differences existed amid races for large tumors/advanced histologies where US-guided FNA would not be used diagnostically. For all races, Medicaid/uninsured cases (vs. insured) were less associated with papillary carcinoma (OR=0.88, 95% CI=0.82-0.95; $P < .0001$) and tumors <20 mm (OR=0.74, 95% CI=0.71-0.78; $P < .0001$).

Conclusions: Use of US-guided FNA is not the sole reason for increasing incidence or variation between races. Race/ethnicity is a determinant of thyroid cancer size/histology at diagnosis. Private insurance cases are diagnosed at earlier tumor stages and sizes than Medicaid/uninsured cases.

P-35

THE IMPACT OF A CANCER DIAGNOSIS ON THE SURVIVAL OF HIV-INFECTED INDIVIDUALS LIVING IN SOUTH CAROLINA IN THE POST-ART ERA

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Objective: To determine the impact that a cancer diagnosis has on the survival of HIV-infected individuals when compared to HIV-infected patients without a cancer diagnosis, controlling for the risk of developing cancer.

Design: Population-based retrospective cohort study.

Methods: Data on all individuals diagnosed and alive with HIV/AIDS in South Carolina between 1996-2010 were obtained from the enhanced HIV/AIDS Reporting System. Data on all individuals with co-morbid HIV and cancer diagnoses during this time were obtained from the South Carolina Central Cancer Registry. Cox Proportional Hazards (PH) models were used to determine the impact that a cancer diagnosis had on the survival of HIV-infected individuals. To adjust for their risk of acquiring cancer, we used an inverse probability of treatment weights Cox PH model.

Results: Of the 1,292 cancer cases that were diagnosed among HIV-infected individuals during the study, 1,068 individuals remained after applying exclusion criteria. As expected, initial Cox PH models found that cancer diagnoses significantly impacted the survival of HIV-infected individuals with adjusted hazard ratios (aHR) ranging from 4.5-36. The impact of a cancer diagnosis was most severe among HIV-infected individuals who had not been diagnosed with AIDS (aHR: 19-36). When controlling for individuals' risk of developing cancer, the HR associated with a cancer diagnosis significantly increased for both patients diagnosed with HIV (aHR: 35.0-67.6) and AIDS (aHR: 7.1-7.2).

Conclusion: We found that adjusting for risk factors that lead to a cancer diagnosis among HIV-infected individuals using a propensity score analysis had a prominent effect on the risk of survival in our study population. Our results suggest that studies that fail to adjust for individual's likelihood of developing cancer may dramatically underestimate the impact that receiving a cancer diagnosis has on their survival.

P-45

THE IMPACT OF A PRIOR HIV/AIDS DIAGNOSIS ON THE SURVIVAL OF CANCER PATIENTS**B Hallowell¹**, S Robb¹, K Kintziger², C Whalen¹¹University of Georgia, Athens, GA, United States; ²University of Tennessee, Knoxville, TN, United States

Objective: To determine whether HIV infection modifies the survival experience of cancer patients based on cancer type or organ system and if cancer treatment and/or time to initiation of cancer treatment varies based on HIV status.

Design: Retrospective cohort study with group matching by cancer type and year of cancer diagnosis.

Methods: Data on all individuals diagnosed and alive with HIV/AIDS in South Carolina between 1996-2010 was linked to the South Carolina Central Cancer Registry (SCCCR) to obtain all HIV+ cancer cases that occurred during that time. An HIV- cancer comparison group was selected from SCCCR at a ratio of 1:5 matched on cancer site and year of cancer diagnosis. Cox Proportional Hazards (PH) models were used to determine the impact that a prior HIV/AIDS infection had on the survival of cancer patients.

Results: Of the 1,292 cancer cases diagnosed among HIV-infected individuals living in South Carolina between 1996-2010, 1,068 HIV-infected cancer cases met our initial inclusion criteria. HIV-infected cancer patients were not less likely to receive cancer treatment, and did not have significantly longer times to the initiation of cancer treatment. When compared to the HIV- cancer comparison group using all cancer cases, a previous HIV infection had a significant impact on patients' survival (hazard ratio [HR]: 2.5). The impact of a HIV on survival varied based on tumor sites and site group and was most severe among individuals with lower stage tumors and those with higher baseline 5-year life expectancies.

Conclusion: HIV-infection is associated with significantly reduced survival among cancer patients, particularly among individuals who exhibit higher 5-year expected survival, those diagnosed at younger ages, and those diagnosed with lower stage tumors.

P-55

ADHERENCE AND PERCEIVED BARRIERS FOR SCREENING OF HEPATOCELLULAR CARCINOMA AMONG HIGH-RISK CHINESE PATIENTS**K Xu^{1,2}**, S Watanabe-Galloway¹, F Rochling¹, P Farazi¹¹University of Nebraska Medical Center, Omaha, NE, United States; ²Nebraska Department of Health and Human Services, Lincoln, NE, United States

Background: China alone accounts for approximately 50% of the total number of hepatocellular carcinoma (HCC) cases and deaths globally. Considering its poor prognosis when diagnosed late, guidelines recommend biannual HCC screening with abdominal ultrasound and serum alpha-fetoprotein (AFP) test for high-risk populations. However, no study has yet investigated patients' knowledge and barriers associated with HCC screening.

Objectives: To investigate the adherence, knowledge and self-perceived barriers for HCC screening among high-risk Chinese patients.

Methods: An interview-based questionnaire was conducted among Chinese patients with cirrhosis, chronic hepatitis B, and/or chronic hepatitis C infection from outpatient clinics at two tertiary medical institutions in Shanghai and Wuhan.

Results: Among 352 participating patients, 50.0% had routine screening, 23.3% had irregular screening, and 26.7% had incomplete or no screening. Significant determinants for screening included higher level of education, underlying liver cirrhosis, family history of HCC, and better knowledge level concerning viral hepatitis and HCC screening guidelines. Moreover, factors associated with better knowledge level were younger age, female gender, urban residency, education level of college or above, annual household income greater than 150K RMB, and longer duration of hepatitis infection. The most frequent barriers reported for not receiving screening were not aware that screening for HCC exists (41.5%), no symptoms or discomfort (38.3%), lack of recommendation from physicians (31.9%), and not knowing the benefits of screening (22.3%).

Conclusions: Healthcare professionals and community leaders should actively inform high-risk patients regarding the benefits of HCC screening through design of educational programs. In addition, the approach of entering patients into disease management programs and providing automatic reminders could potentially improve screening adherence.

P-85

NEBRASKA IMMIGRANT POPULATIONS AND CANCER: A COMPREHENSIVE ANALYSIS USING THE NEBRASKA CANCER REGISTRY DATABASE

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Background: The Nebraska Cancer Registry (NCR) started collecting data in 1987 and has roughly 200,000 cases. There is currently a lack of studies examining the cancer status of immigrant populations using statewide database.

Objectives: To access cancer status of Nebraska immigrants based on linked NCR data, and to examine the clinical and demographic characteristics of immigrants with cancer.

Methods: Statewide linkage was performed between NCR file and an immigrant file obtained from the Nebraska Department of Health and Human Services (NDHHS) Medicaid Program. Immigrant populations in the analysis included, but were not limited to, lawful permanent residents, refugees, asylees, Cuban and Haitian entrants, and paroled aliens. For data linkage, Link Plus software was utilized and manual review was performed after linkage.

Results: Among a total of 14,539 immigrants, 176 were matched to have been diagnosed with cancer. The eight most common cancers consisted of the breast (n=38), thyroid gland (n=20), prostate (n=14), kidney and renal pelvis (n=12), colon and rectum (n=11), non-Hodgkin lymphoma (n=11), lung (n=10), and oral cavity (n=9). Descriptive analysis on clinical characteristics demonstrated that 47% of cases had stage of localized, 26% were regional, 19% were distant, and 8% were unstaged. There were 111 females and 65 males, and vital records showed that 164 were alive and 12 had passed away at the time of analysis. Additionally, 31.3% of cases were diagnosed in 2009 or earlier, and 14.2% of immigrants were diagnosed between the ages of 40–49, followed by 11.4% between the ages of 30–39.

Conclusion: Cancer surveillance among immigrant populations is crucial. The findings illustrated that there is a relatively large number of immigrants with thyroid cancer. Furthermore, compared to non-immigrant cancer populations, the age of diagnosis for breast cancer tended to be younger among immigrant cancer populations. Further studies are warranted to examine cancer screening status of Nebraska immigrants.

P-95

ESTIMATING THE IMPACT OF A CANCER DIAGNOSIS ON LIFE EXPECTANCY BY SOCIOECONOMIC GROUP FOR A RANGE OF CANCER TYPES IN ENGLAND

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Background: In the U.K., survival after a cancer diagnosis varies by socioeconomic status and despite national policies aimed at reducing inequalities, any changes have been minor. Loss in expectation of life is an intuitive and easy to interpret measure that can aid in better understanding the impact of cancer for the whole lifespan.

Purpose: To provide estimates for the impact of a cancer diagnosis on life expectancy by deprivation group for a range of cancer types in England and to fill the gap for policy-making and communication of cancer.

Methods: Data consist of approximately 2.5 million patients who were diagnosed with melanoma, prostate, bladder, breast, colon, rectum, lung, ovarian, and stomach cancer in England between 1998 and 2013. We fitted flexible parametric relative survival models and constrained all time-dependent excess hazard ratios for the effect of deprivation to be proportional beyond a given point in follow-up time to ensure that we do not extrapolate a misleading protective effect. A period analysis was also conducted. We estimated the average loss in expectation of life and the proportion of life lost as well as the total number of years lost due to each cancer.

Results: Lung and stomach cancer result in the highest overall loss in all deprivation groups in terms of both absolute life years lost and loss as a proportion of expected life remaining. Based on those diagnosed in 2013, female lung cancer patients in the least and most deprived group lose 86.1% and 87.3% of their average expected life years remaining. Melanoma, prostate and breast cancer have the lowest overall loss. At a population level, lung cancer results in the largest total life years lost followed by breast cancer even though it affects only females.

Conclusion: We observed a gap between deprivation groups that suggest that further action is required to tackle inequalities. Loss in expectation of life measures can be used to explore variation and thus their use is encouraged.

P-105

ESTIMATED FEMALE BREAST CANCER MORTALITY-TO-INCIDENCE RATIOS (MIRS) ON SENATORIAL DISTRICTS GROUPED TO COUNTY BOUNDARIES IN MISSOURI, 2008 - 2012**A Ramadan**^{1,2,3}, J Jackson-Thompson^{1,2,3}, C Schmaltz^{1,2}¹Missouri Cancer Registry and Research Center, Columbia, MO, United States; ²Department of Health and Management and Informatics, School of Medicine, University of Missouri-Columbia, Columbia, MO, United States; ³University of Missouri Informatics Institute, University of Missouri-Columbia, Columbia, MO, United States

Background: There are racial and age inequalities in cancer incidence and mortality. For many cancer types, the incidence rates are higher among blacks than whites, and for breast cancer in particular, blacks get diagnosed with more aggressive cancers at younger ages than whites.

Purpose: To measure and visualize mortality-to-incidence ratios (MIRs) on senatorial districts grouped to county boundaries (SDGCs) to explore the Female Breast Cancer (FBC) racial and age disparities in Missouri.

Methods: The MIRs by age and race for the FBC cases were calculated by dividing the age-adjusted FBC mortality rates by the age-adjusted FBC incidence rates for the 20 SDGCs for the period 2008-2012. The 95% confidence intervals of the calculated MIR ratios were calculated on the log-scale using the delta method and then transformed back to the original scale. These FBC mortality data were only available down to the county- and the SDGC-level, so we matched mortality rates to the incidence rates on these same geographical levels rather than doing a senatorial district-level analysis.

Results: For the 65+ years-old FBC cases, the MIRs for the whole of Missouri and the 20 SDGCs were typically twice the MIR for the <50 and 50-64 years-old categories. Although we were not able to measure all the MIRs for blacks due to very low FBC cases and due to confidentiality issues, we found that the MIRs for all of Missouri and the compared SDGCs were higher for blacks than whites.

Conclusions: FBC MIRs can be used as a measure of cancer inequalities in Missouri by geographic area. These measures might be informative for policy makers to assess the existing policies and enforce effective interventions to tackle FBC disparities.

P-115

USING BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM (BRFSS) DATA TO ESTIMATE COUNTY-LEVEL COLORECTAL CANCER SCREENING PREVALENCE IN MISSOURI (MO)**J Du**^{1,2}, CL Schmaltz^{1,3}, J Jackson-Thompson^{1,3,4}¹Missouri Cancer Registry and Research Center, Columbia, MO, United States; ²University of Missouri-Columbia, Department of Statistics, Columbia, MO, United States; ³University of Missouri-Columbia, School of Medicine, Department of Health Management and Informatics, Columbia, MO, United States; ⁴University of Missouri Informatics Institute, Columbia, MO, United States

Background: County-level colorectal cancer screening (CRCS) prevalence cannot be directly obtained from MO BRFSS data due to small sample sizes. Missouri's BRFSS-like County-level Study (CLS) can obtain direct county-level estimates—but CLS is not regularly conducted. We want to study the possibility of predicting county-level prevalence using the BRFSS, which collects CRCS data biennially.

Purpose: Use small area estimation techniques to estimate county-level CRCS prevalence in Missouri for people age 50+ with 2012 BRFSS data and compare with results from 2011 CLS.

Methods: CRCS rates were predicted using a variety of Bayesian binomial regression models with county, gender, age (5-year spans), race (white and non-white), and county attributes (income and education). The models were inspired by CDC's U.S.-wide county-level diabetes prevalence model (Cadwell et al. 2010). The direct estimates from CLS were used to evaluate the models.

Results: The models strongly shrank the county-level estimates together. Counties with large sample sizes in BRFSS had reasonable direct estimates; most counties had too small sample sizes. Moreover, one-third had no survey respondents. The model-based estimates for small/zero sample size counties were primarily synthetic and were potentially driven by population characteristics, yet the demographics had relatively little effect and the estimates were largely pulled toward the overall mean. The direct estimates from CLS used for evaluation still had fairly large confidence intervals (CIs). The model-based point estimates mostly fell within the 95% CIs of the direct estimates.

Discussion: The large CIs from the CLS hinder the ability to evaluate the model-based estimates. The project is ongoing; future work includes further examination of the population groups and covariates in the models. Potential barriers include accessibility of detailed population data; moreover, it may be difficult to predict these prevalence just by population demographics.

P-12S

AMERICAN THYROID ASSOCIATION (ATA) GUIDELINE ADHERENCE AND PHYSICIAN-BASED BARRIERS AND FACILITATORS OF INITIAL TREATMENT FOR DIFFERENTIATED THYROID CANCER IN CANADA AND THE UNITED STATES: A SYSTEMATIC REVIEW

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Background: The American Thyroid Association (ATA) first published clinical guidelines for differentiated thyroid cancer (DTC) management in 1996, with updates as recent as 2015. Nevertheless, disparities in DTC treatment exist within Canada and the United States. We synthesized: (1) the level of adherence to initial DTC treatment recommendations, and (2) physician-based barriers or facilitators of that treatment.

Methods: We undertook a systematic review and searched published and grey literature from January 1996 to December 2016 that examined ATA guideline adherence and/or physician-based barriers to, or facilitators of, DTC treatment among: (1) adult populations in Canada or the United States, or (2) among physicians using case vignettes.

Results: Eighteen studies met inclusion criteria and five of these specifically examined ATA guidelines, primarily for extent of surgery, central neck dissection (CND), and radioiodine (RAI) ablation. Outcome measures were incompletely reported across many studies. Surgical extent (lobectomy or thyroidectomy) had the highest level of adherence in recent periods (70-98%), CND levels were typically 70%, and RAI ablation adherence lower at approximately 60%. Clinical or patient factors such as micronodules or family history introduced variation in management and lower guideline concordance. Physician experience, clinical practice setting and beliefs were both barriers and facilitators to treatment depending on context, but no qualitative studies were identified to better elucidate physician beliefs.

Conclusions: More complicated case scenarios introduced variation in treatment patterns and discordance with ATA recommendations. Use of RAI does not appear to be selective, contrary to guidelines. Knowledge dissemination opportunities exist to establish the use of evidence-based guidelines exist among American and Canadian physicians. This may help reduce disparities in DTC treatment, where physicians may represent a systemic factor.

A

Abastillas, G P-21
 Abel, G 3A2
 Abrahao, R P-48*
 Agovino, P P-54
 Ahern, D 2A2
 Alexandersson, A 5C3*
 Aljehani, M 3E3
 Allemani, C 2E1*, 2E2, 2E4, P-53
 Alvarado, M P-63*
 Alverson, G 4F2, P-11
 Amanda, L 5E4
 Anam, A 2D2*
 Andall-Brereton, G 1A3
 Anderson, R 5PL1*
 Andersson, TM 1E1*, 1E2, 3F2S, P-9S, 1F4S
 Andrews, E 3C1
 Arya, N 4B4
 Astor, M P-52, P-56*
 Austin, AA 5D2, P-8
 Ayodele, O P-64

B

Bahiril, K 3E3
 Balamurugan, A P-52
 Baltic, R P-60
 Bannister, N P-44
 Baral, S 3D2, 4B4
 Barnholtz-Sloan, JS 3F1S, P-38
 Barry, M 2B4, 3PL2
 Bartlett, G 1C2
 Bayakly, A P-27
 Beaumont, K 1B3
 Benard, V 4F1, 4F2*, P-11, 1B
 Berkowitz, Z 3PL1
 Berwich, M 2PL2*
 Bhattacharya, T 4PL2*, 4B1
 Björkholm, M 1F4S, 3F4S
 Bledsoe, C 1A2*, 1B2
 Blumenthal, W 4B3, 4B4, 4F3*
 Bolick, S 1A4, 1F5S
 Bolton, D 3E4
 Bomb, M P-45
 Bonaventure, A 2E1, 2E4
 Boscoe, F 5D2, P-10
 Botchway, A P-23

Boten, J 2A2, 4B1*
 Botsis, T 4B4
 Bower, H 1E2, 3F2S*, P-9S
 Bowers, L 1A1*
 Brant, M P-29, P-1
 Brard, L 2F3S
 Brettin, T 4B1
 Brewster, D 5D1
 Broadfield, L 1C2
 Brock, R P-17
 Broggio, J P-44
 Brown, R P-52
 Bryan, S 1C1, 3B3
 Bryant, H 1PL1*, 2E2
 Buckman, D 4D2

C

Caban-Martinez, A 2C2
 Caldas, M 4B4
 Calvert, GM P-15
 Campbell, S 4B4
 Canchola, A 4E2, 5D4, P-42
 Capron, S 1B3
 Carlin, B 1A1
 Carmona, A 2C4
 Carrière, G 1C1
 Castera, M 1A4
 Castonguay, J 1A1
 Centeno-Rodriguez, O P-28
 Cernile, G 5B3*
 Charlton, M 5A1*, 2F2S, P-2S
 Charnock, J 2A1
 Chen, C 3D3
 Chen, Q 3B2
 Chen, V 5A1
 Chen, W 4B4
 Chen, Y P-41*, 4E5
 Cheng, I 4E1
 Cheng, S 4A1*
 Chiarelli, A 5E1
 Chui, R 2F1S*
 Church, A 1C4
 Ciornii, G P-31*
 Clerkin, C 4C1*, 4C2, 4C3
 Clerville, J 1F5S*
 Clough-Gorr, K 5D1
 Clugstone, S 3C5, 1F5S

Cocke, A 5A2
 Coggins, C P-09
 Colditz, G 2F3S
 Coleman, M 2PL1*, 2E1, 2E2, 2E4, 2E4
 Coupland, V P-17
 Cozen, W 5B4
 Crawford, A 4F2, P-11*
 Cress, RD 2F4S, 4E3*
 Cronin, K 3B4, 4A1
 Crosbie, AB 5A3*
 Crowther, MJ 3F2S
 Curran, D 3D2

D

Dabbous, FM P-34
 Davis, HT 3C5
 Davison, T P-2*, 4A4
 Day, G P-61
 de Carvalho, TM 2D4
 de Koning, HJ 2D4
 De, P 2C4, 2D2, 5E1
 Deapen, D 2D1, 4C1, 4C2*, 5B5, P-62
 DeCourtney, C P-61
 Delongchamp, R P-52, P-56
 DeMair, K 1F2S*
 Dement, M P-6
 Demissie, K 1F2S
 Depry, F 1B1*
 DeSantis, C P-66*
 Dexter, P 1C4
 Dhillon, P 2PL3*
 Di Carlo, V 2E1
 Dickie, L 1C3, 3B4
 Dickman, PW 1F4S, 3F2S, 3F4S
 Dilts, D 4A1
 Dite, G 5B4
 Dodwell, D P-45
 Dolecek, TA P-34*
 Dong, X 1E4*
 Douglas, L P-20
 Drennan, C 3D3
 Du, J 5E3, P-11S*
 Dunn, M 5A4
 Durbin, E 3E1*

Author Index

E

Eckert, G..... 1C4
 Edwards, SA..... 3E5
 Eisen, A..... 5E1
 Ellis, E..... 4E2
 Ellison, LF..... 3B3*
 Elliss-Brookes, L..... 2A1*, 3A2*, P-17*,
P-37*, P-44, P-57*
 Eloranta, S..... 1F4S, 3F4S
 Encissa, C..... 3F3S
 Epplein, M..... 2D3
 Erdrich, J..... 3PL1
 Esebua, M..... P-32
 Espey, DK..... 2B1
 Espinoza, R..... P-40*, P-6
 Esterly, M..... 1B3*
 Etzioni, R..... 2D4*, P-68

F

Fallahpour, S..... 2D2
 Farazi, P..... P-5S
 Farhoomand, G..... 2D2
 Fearn, P..... 1B4, 2A2, 4A1, 4B1, 5C1
 Feuer, E..... 1D1*, 3B1, 4A1
 Fisher, J..... P-60
 Flannel, M..... 4E4
 Fleming, S..... 3B2
 Foster, M..... 4B4
 Francis, B..... 5E3
 Fraser, A..... 3E5
 Freeman, M..... 3A5*, 4F1
 Friedman, S..... 4A1, 4C2

G

Galin, O..... P-20
 Gammon, A..... 3E5
 Garvin, JH..... 3E4
 Gavin, A..... 5D1
 Gehlert, S..... 4E4
 George, J..... 3A1
 Gershman, S..... P-46, P-49
 Gibbons, C..... 2A2
 Giddings, BM..... 4E5*
 Giljahn, I..... P-60
 Gillespie, T..... 2PL3
 Gilsenan, A..... 3C1
 Glanz, K..... 5D3

Glimelius, L..... 1F4S, 3F4S
 Goldberg, D..... 4E1
 Gomez, SL..... 4E2*, P-42*
 Gonsalves, L..... P-26
 Goodman, M..... 2PL3
 Greek, A..... 4F2, P-11
 Greenbaum, A..... 5A1
 Gress, D..... P-3*
 Groves, C..... P-12, P-13
 Gulati, R..... 2D4, P-68*
 Guthrie, L..... 3E3
 Gupta, R..... 2PL3

H

Habif Jnr, D..... 4E4
 Haddock, K..... P-37
 Haggstrom, D..... 1C4
 Hallowell, B..... P-3S*, P-4S*
 Hamdi Cherif, M..... P-35, P-36
 Hamilton, AS..... 5B4*
 Hamm, J..... 1A1
 Hands, I..... 3D2*, 2F1S
 Harewood, R..... 2E1, 2E4*
 Harrington, K..... P-22*
 Harris, D..... 3C1*
 Harrison, J..... 4A3*
 Hashibe, M..... 3E4
 Haverkamp, DS..... 2B1, 3PL1
 Hawes, D..... 5B4
 Hawley, CW..... 3E4
 He, J..... 1C4
 Heijnsdijk, E..... 2D4
 Henley, SJ..... 4F4, P-24*, P-25*, P-65*
 Henry, D..... 2B3
 Henry, K..... 4D4, 3E2, P-17
 Herget, K..... 3E2, 3E4
 Herman, N..... 1F2S, 3C2*, P-11
 Herna, M..... 2C1
 Hernandez, MN..... 2C1*, 2C2
 Hesse, B..... 2A2
 Hiatt, RA..... 5D4
 Hill, SM..... P-16, P-23*
 Hintz, D..... 4A4
 Holowaty, EJ..... 3F3S
 Holt, A..... P-52*
 Holt, D..... 5A4*
 Hopper, J..... 5B4
 Hounsorne, L..... 3C3*, 5D1*, P-18, P-44, P-45*

Hovmand, P..... 4E4
 Howe, W..... 4C3, 4C4
 Hsieh, M..... 5E2, P-11, P-21, P-30
 Huang, B..... 1D3*, 3B2*, 5E2
 Hughes, AG..... P-34
 Huh, W..... P-11
 Hui, S..... 1C4
 Humphreys, K..... 1E1
 Hunter, K..... P-17
 Hunter-Merrill, RA..... 2D4
 Hurley, D..... 3C5*
 Huston, L..... 3E2
 Huws, D..... 5D1

I

Induni, M..... 4A4, 5B2, P-69

J

Jabo, B..... 3E3
 Jackson, JE..... P-11
 Jackson-Thompson, J..... E3, P-32, P-33*,
P-47, P-10S, P-11S
 Jacquez, G..... 2A3*
 Jamal, S..... 2B3*
 James, A..... 2F3S, P-66
 Jemal, A..... 5E2
 Jenkins, J..... P-44
 Jenkins, W..... 2F3S
 Jiang, H..... 5E1*, 3F3S
 Jim, CC..... 2B1
 Jim, MA..... 2B1*
 Jim, M..... 3PL1
 Johal, G..... P-37
 Johansson, A.L.V..... 3F4S
 Johnson, C..... 4C3*, P-53
 Johnson, JD..... P-23
 Johnson, K..... 3C5
 Johnson, S..... P-57
 Jones, C..... 2B3
 Jones, S..... 3D2, 4B3, 4B4*
 Joseph, D..... P-53
 Ju, J..... P-15

K

Kahl, A..... 5A1, P-2S, 2F2S*
 Kahn, AR..... P-8*
 Karlit, J..... 5A1

Author Index

Katz, H.....P-16
 Katz, S.....5B5*
 Keating, K.....5C2
 Keith, S.....5D3
 Kelley, S.....P-61
 Kewayosh, A.....2B3
 Khan, S.....3PL3
 Khan, U.....P-33
 Killion, JA.....P-39*
 King, J B.....P-24
 King, MJ.....2C4*
 Kintziger, K.....P-3S, P-4S
 Kirchhoff, AC.....3E4
 Kizer, K.....4E5, P-39, P-41, P-67, 1F3S
 Klapheke, AK.....4E3, 2F4S*
 Klaus, C.....P-09*
 Knowlton, R.....P-49*
 Kobetz, E.....2C2
 Kohler, B.....4C1, 4C3
 Kohlmann, W.....3E5
 Kohn, E.....3B4
 Kolli, A.....1B2
 Kolli, S.....1A2
 Kollman, J.....P-60
 Koru-Sengul, T.....2C2
 Kosary, C.....1B1, 4A1
 Krebs, P.....P-25
 Kreimeyer, K.....4B4
 Kristinsson, SY.....3F4S
 Krol, F.....P-16
 Kromer, C.....P-38
 Kruchko, C.....5E2, P-38, 3F1S
 Kumar, N.....P-64
 Kundeti, H.....4A4*, 5B2*, P-69
 Kurian, A.....4PL3, 5B5
 Kwan, D.....4B3

L

Lake, A.....4C3, 4C4*
 Lake, J.....4B1
 Lam, C.....1C3, 2A2, 4A1, P-21*
 Lambe, M.....3F2S
 Lambert, PC.....1E2, 1F4S, 3F2S, P-9S
 Leader, A.....5D3
 Leal, Y.....1PL2
 Lee, DJ.....2C2*
 Lee, G.....4B3*
 Lefante, C.....4D4*

Lemieux, M.....P-23
 Levin, G.....1A4*, 2C1
 Li, J.....P-50, P-51*, 1F2S
 Li, X.....5E2, P-30
 Liddy, J.....1C2
 Lin G.....S4E1*, 5D4, P-48
 Lin, C.....5A1
 Lipscomb, J.....3B2
 Lipscombe, L.....P-12S
 Liu, B.....3B1, 4C4
 Liu, G.....1A1
 Liu, L.....2D1, P-62*
 Lozada, C.....1F2S
 Lozon, NL.....3A1
 Louzado, C.....1C2
 Lum, S.....3E3
 Lu-Yao, G.....3C2, 1F2S
 Ly, K.....1A1
 Lynch, C.....3C5, 5A1, 2F2S, P-2S
 Lyratzopoulos, G.....2A1, 3A2, 3D3

M

Mabie, J.....5C2
 Macarol, T.....P-34
 MacIntyre, M.....1C2
 MacKinnon, J.....1A4, 2C2
 MacMillan, A.....P-46*
 Magno, P.....P-70
 Maguire, F.....1F3S*, F P-41
 Mahdi, I.....1F1S*
 Mak, V.....P-37
 Makkar, N.....3F1S
 Maniscalco, L.....4D4
 Mariotto, A.....1C3, 2D4, 4A1, P-68
 Marrett, L.....3PL4, 2B3, 2B4
 Marshall, E.....1F2S
 Martin, J.....1C4
 Martinez, L.....P-3S
 Martinez, S.....3PL3
 Matatova, M.....1B4*
 Mathew, S.....5C2
 Matt, B.....2F2S
 Matz, M.....2E1
 McClure, LA.....2C2
 McDougall, K.....1C2
 McFadden, S.....3E2*
 McFarlane, T.....5A2
 McIntire, R.....5D3

McKinley, M.....5D4*, P-48
 McLaughlin, J.....3F3S
 McNamara, C.....P-27
 McPhail, S.....3A2, P-57
 Mehrotra, R.....2PL3
 Meisner, A.....3PL2, 2B4, 1F1S
 Melkonian, S.....3PL1*, 2B1
 Mendonca, S.....3A2
 Mesnard, M.....P-13*
 Midkiff, K.....3C1
 Miller, E.....5C2*
 Minasian, L.....3B4
 Mohan, V.....2PL3
 Mohar, A.....1PL2*
 Moldwin, R.....3D2, 4B3
 Montemurno, H.....P-23
 Moody, C.....P-1*
 Moore, D.....3C2, 1F2S
 Moravec, R.....1B4
 Morgan, JW.....3E3*
 Morris, CR.....1F3S, 4E5, P-15, P-39, P-41, P-67
 Morris, J.....3C3
 Muradali, D.....5E1
 Murison, P.....1RF3, 1A1, 1C1*
 Murphy, R.....P-44

N

NAACCR V.5. Task Force.....2A4*
 Nagelhout, S.....P-6*, P-40
 Nash, S.....3PL2*, 2B2*, 2B4*, P-61*
 Navaneelan, T.....2D2
 Negoita, S.....4A1, 5A4, P-21
 Newbound, S.....3D3
 Newton, J.....3C3
 Ng, D.....P-12*, 5C4
 Nicolin, PG.....3A1
 Nikši, M.....2E1
 Nishri, D.....3, PL4, 1E3*, 2B3, 2B4, 2E2, P-58
 Nitcheva, D.....3C5
 Noel, L.....4E4
 Noonan,1A1
 Noone, A.....1C3, 3B4*
 Norwood, TA.....3F3S*, P-12S*
 Nowlin,P-14*
 Nucci, L.B.....P-43
 Nugent, R.....2PL3
 Nunez, C.....3C2

Author Index

O

Oancea, S.C.....P-43*
 O'Brien, DK.....P-5*, P-55*
 O'Flarity, M.....P-11
 Okolo, R.....P-75*
 O'Neil, ME.....P-24
 Opiekun, R.E.....5A3
 Ortiz-Ortiz, KJP-28, P-70*
 Ostroff, JSP-25
 Ostrom, QT.....3F15*, T P-38*
 Ouyang, F1C4

P

Paddock, L.....3C2
 Paddock, L.E.5A3, P-38*, P-50, P-54
 Pagedar, N.....2F2S
 Pandey, A.....4B4
 Parikh-Patel, AP.....4E5, P-39, P-41, P-67*, 1F3S
 Paskett, EP-60
 Pate, A.....P-40
 Patel, S.....2PL3
 Patrick, J.....4B2*, 4B4
 Pawlish, KS5A3, P-16, P-50*
 Peace, S1A4, 2C1
 Pearson, J4D1, 4D3*
 Pelletier, C3B3
 Penberthy, L1RF1, 5PL4, 1C3, 3B4,
4A1, 4B1, 4C1, 4C2, 5C1
 Petkov, V1C3, 4A1, B1*, 5B5
 Phillips, CP-26*
 Pickle, L4D1*, 4D3
 Pinsky, P5C2
 Platz, C.....2F2S
 Pole, JD.....3PL4, 2B4
 Pollack, L.....1B2*, 4F4
 Poole, JP-44
 Prabhakaran, D.....2PL3
 Pratt, J.....1A4
 Provenzano, E5B4
 Provost, E.....2B2
 Prummel, M.....3PL4, 2B3

Q

Qiao, B5D2, 5E2, P-8
 Qu, M.....P-6S, P-8S
 Quesnel-Crooks, S.....1A3*

R

Raftery, A5A2*
 Rahal, R.....2E2
 Ramadan, AP-10S*
 Ramus, S.....5B4
 Ranasinghe, S.....P-20
 Rao, C2C3*, P-22
 Rashbass, J3D3, 5D1, P-44
 Rath, GK2PL3
 Reilley, B.....3PL1
 Rauscher, GH.....P-34
 Remen, CP-1
 Ren, Y1E4, P-20
 Reynoso, N1PL2
 Richards, J.....P-19*
 Richardson, L.....5PL2, 1B2
 Riley, T.....5C2
 Rim, SHP-53
 Rios-Motta, R.....P-70
 Rivera, D.....1C3*, 5C1*
 Robb, SP-3S, P-4S
 Roche, LM.....5A3
 Rochling, FP-5S
 Rodrigues, EGP-64*
 Rodriguez, D2F4S, 5B2, P-1S*, P-69*
 Rogers, EP-25
 Rogers, J.....1A2, 1B3, 3D2, 4B4, 4F3
 Román-Ruiz, YP-28*
 Romero, M.....P-16
 Romieu, I.....P-59
 Romney, D.....3E2
 Rosella, L.....P-12S
 Roshala, W.....4A2*
 Ross, F3E1
 Ross, W5C4*
 Rotter, D3C2, 1F2S
 Rousseau, DP-4*
 Ruppert, L.....1C4*
 Rutherford, MJ.....1E1, 1E2*, P-9S
 Ryan, L4F3
 Rycroft, R4C3
 Ryerson, A4F4
 Ryerson, B.....1A2, 1B2, 3A5, 3B2

S

Salahuddin, N2C3
 Sales, A4B1
 Sanmartin, C.....1C1
 Sarin, HB.....3E5
 Sawaya, R.....P-38
 Saxon, E.....P-45
 Scharber, W.....2C1, 4F3
 Schmaltz, CL.....5E3*, P-47, P-10S, P-11S
 Schumacher, PKP-15
 Schwartz, SP-16*
 Schymura, MJ.....5D2*, P-8
 Scocozza, M.....P-1
 Seiffert, J.....3D2*
 Selig, J.....P-56
 Selleck, M3E3
 Senthil, M.....3E3
 Setiawan, VW4E1
 Shaikh, Y2A2*
 Shand, B.....3D3, P-17
 Shariff-Marco, S.....P-48
 Shaw, A3C4
 Sheikh, A.....P-40, P-6
 Sheppard, A.....2B3
 Sherman, R.....4C1, 4C3, 5E2
 Shoemaker, MP-59*
 Shore, RD3A1
 Sidhu, B1A1
 Siegel, D.....4F4*
 Silver, SP-14, P-15*
 Simoes, EP-47
 Sineshaw, H5E2
 Singh, S.....1B2
 Sipin, A2D1*, P-62
 Smedby, KE3F4S
 Smittenaar, R.....P-45
 Sobotka, HP-60
 Solutions, C.....P-2
 Southey, M.....5B4
 St. Pierre, C1A1
 Stewart, AK1RF2
 Stabinsky, H.....P-23
 Stanger, JP-20
 Stearns, P1A4, 2C1
 Stephens, J.....P-60*
 Stern, K5C4, P-12, P-13
 Stevens, L.....1PL3*

Author Index

Steward, D.....2F3S
 Stinchcomb, D2A2, 4D4
 Stroup, A.....5PL5, 3C2, 4F2, 5A3, P-11, P-16,
P-23, P-50, P-51, P-54*, 1F2S
 Suarez-Ramos, TP-70
 Summerfelt, WTP-34
 Sutliff, A.....P-1
 Swaminathan, R2PL3
 Sweeney, C.....3E2, 3E4*, 3E5*
 Syriopoulou, E1E2, P-9S*

T

Tai, C5D4
 Tai, E.....3B2
 Tatalovich, Z2A2
 Temkin, SM3B4
 Thomas, C.....4F2
 Thompson, T5E4
 Tjepkema, M.....3PL4, 2B4
 Torres Cintrón, CR.....P-28, P-70
 Torres, MP-57
 Tortolero-Luna, GP-70
 Tourassi, G4B1
 Tran, Q1C3
 Traverso-Ortiz, M.....P-12
 Treasure, P.....3D3
 Tsai, K2D1
 Tsai, RJP-15
 Tsodikov, A2D4
 Tsui, J.....3C2, 1F2S
 Tucker, T1D2*, 3B2
 Tung, J.....2D2
 Turner, D2E1, 2E2

V

Van Heest, S.....4F1*
 Varga, M2D3
 Vasanthan, SP-50
 Veintidos-Feliu, AJP-70
 Verne, J3C3
 Vernon, S3D3
 Viens, LP-65
 Vigneau, FD3A1*
 Von Behren, J4E1
 Vriends, K.....1A1, 1C2*

W

Walderhaug, M4B4
 Walker, I.....P-27*
 Walker, J2B3
 Wallington, MP-45
 Wang, T3F3S
 Wang, W4B4
 Wang, YP-58*
 Ward, K4PL1*, 3B2, 5B5
 Warther, B.....P-60
 Watanabe-Galloway, SP-5S, P-6S, P-8S
 Watson, M4F2
 Weeks, K.....P-2S*
 Weibull, CE1F4S*, 3F4S*
 Weir, H2E1, 2E2*, P-59
 Whalen, CP-3S, P-4S
 White, C.....5D1, P-18*
 White, M.....3PL1, P-59
 Whiteside, M2D3*, P-19
 Whitlock, JM.....3A1
 Withrow, D.....3PL4*, 2B4
 Wickenden, M.....P-45
 Wickliffe, T.....3PL3
 Wiggins, C3PL1, 3PL2, 1F1S, 2B4
 Wigren, K.....3E2
 Wike, J.....4F4
 Williams, F4E4*
 Williams, M.....3D3
 Williams, T4F1, P-20
 Wilson, R1E4, 5E4 3A3*, 3A4*, 3A5, P-20
 Wohler, B.....5E2
 Wong, HP-25
 Wong, K.....P-44
 Wood, S.....P-29*
 Wu, M.....4F1, 5E2*, 5E4*, P-59
 Wu, X4F2, 5E2, P-21, P-30

X

Xiao-Cheng, W4D4
 Xu, JP-38
 Xu, K.....P-5S*, P-6S*, P-8S*

Y

Yang, J.....P-48
 Yi, YP-30*
 Yoshida, YP-47*
 Young, N3C3
 Yu, M.....3B1*, 4C4
 Yu, Q5E2
 Yurkiewicz, A2B3

Z

Zachary, IP-32*, P-33
 Zahnd, W2F3S*
 Zaidi, Z.....P-35*, P-36*
 Zakaria, D3C4*
 Zavala-Zegarra, D.....P-28
 Zeigler-Johnson, C5D3*
 Zhang, G4B4
 Zhang, J.....P-62
 Zhang, K.....1E4, P-20*
 Zhang, X.....P-10*
 Zhou, Y3A2
 Zhu, L1D4*, 4D1, 4D2*, 4D3
 Zimpelman, G3PL2, 2B4
 Zoellner, N.....4E4
 Zou, J.....3B1
 Zuk, AP-12S
 Zuniga, MP-1S



Program-at-a-Glance

MONDAY, JUNE 19		TUESDAY, JUNE 20		WEDNESDAY, JUNE 21		THURSDAY, JUNE 22		TIME	
6:30am		RESEARCH & DATA USE STEERING COMMITTEE Sandia/Santa Ana: 7:00am - 8:00am	RISE AND SHINE SESSION Ballroom C: 7:00am - 8:00am	FREE FUN RUN/WALK EVENT Meet in hotel lobby at 6:30am	STEERING COMMITTEE MEETINGS: 7:00am - 7:45am		6:30am		
7:00							7:00		
7:30							7:30		
8:00	PRE-MEETING BREAKFAST: 8:00am - 8:30am	OPENING CEREMONIES: 8:00am - 8:30am	NAACCR BUSINESS MEETING Ballroom C: 8:15am - 8:45am	PLENARY SESSION 3 Cancer Surveillance in American Indians/ Alaska Natives/Canadian First Nations Ballroom C: 9:00am - 10:30am	PLENARY SESSION 4 Registry of the Future Part I Ballroom C: 8:00am - 10:00am		8:00		
8:30	REGISTRY OF THE FUTURE Welcome and Guest Speakers Ballroom C: 8:30am - 10:45am	PLENARY SESSION 1 International Cancer Surveillance Ballroom C: 8:30am - 10:00am						8:30	
9:00								9:00	
9:30								9:30	
10:00		BREAK/POSTERS/EXHIBITS: 10:00am - 10:30am						10:00	
10:30	BREAK: 10:45am - 11:00am	CONCURRENT SESSION 1 Various Sessions 10:30am - 12:00pm	CONCURRENT SESSION 3 Various Sessions 11:00am - 12:45pm	CONCURRENT SESSION 4 Various Sessions 10:30am - 12:00pm			10:30		
11:00	REGISTRY OF THE FUTURE Ballroom C: 11:00am - 12:00pm							11:00	
11:30								11:30	
12:00pm	LUNCH ON YOUR OWN: 12:00pm - 1:00pm	LUNCH ON YOUR OWN 12:00pm - 1:30pm	LUNCH ON YOUR OWN 12:45pm - 2:00pm	LUNCH ON YOUR OWN 12:00pm - 1:30pm			12:00pm		
12:30									12:30
1:00							REGISTRY OF THE FUTURE Breakout Sessions 1:00pm - 2:45pm		1:00
1:30		CONCURRENT SESSION 2 Various Sessions 1:30pm - 3:00pm	SCHEDULED MEETINGS Various Committee and Group Meetings 2:00pm - 5:30pm	CONCURRENT SESSION 5 Various Sessions 1:30pm - 3:00pm			1:30		
2:00									2:00
2:30							BREAK: 2:45pm - 3:00pm		2:30
3:00	REGISTRY OF THE FUTURE Presentations & Closing Remarks 3:00pm - 5:00pm	BREAK/POSTERS/EXHIBITS: 3:00pm - 3:30pm		PLENARY SESSION 5 Registry of the Future Part II Ballroom C: 3:30pm - 5:00pm			3:00		
3:30							3:30		
4:00							4:00		
4:30							4:30		
5:00		NAACCR Lightening Round: 4:40pm - 5:00pm	BIKE RIDE EVENT 4:00pm - 6:00pm	CLOSING CEREMONIES: 4:50pm - 5:15pm	INVITATION TO NAACCR 2018: 5:15pm - 5:30pm		5:00		
5:30	Exhibitor Showcase & Poster Viewing 5:30pm - 7:00pm	Birds of a Feather Picnics: 5:30pm - 6:30pm						5:30	
6:00								6:00	
6:30								6:30	
7:00		2017 OPENING RECEPTION Ballroom C: 6:30pm - 9:00pm					7:00		
8:00									8:00
9:00									9:00