

Cancer Disparities in Idaho

Phase I - Incidence

Understanding Disparities in Cancer Incidence Using Individual and Area-Based Measures

May 2007

Christopher J. Johnson, MPH
Epidemiologist

Stacey L. Carson, RHIT, CTR
Vice President Operations and Registry Services

Cancer Data Registry of Idaho
PO Box 1278
Boise, Idaho 83701-1278
208-338-5100 ext 213 (phone)
208-344-0180 (FAX)
<http://www.idcancer.org>



IDAHO DEPARTMENT OF
HEALTH & WELFARE

Table of Contents

	Page
Abstract.....	1
Introduction	1
Methods	1
Results.....	3
A. Late Stage Breast Cancer per 100,000 Women Aged 40+.....	4
B. Late Stage Cervical Cancer, age 20+	7
C. Late Stage Colorectal Cancer, age 50+	9
D. Lung and Bronchus Cancer	12
E. Oral Cavity and Pharynx Cancer.....	15
F. Malignant Melanoma of the Skin	18
Conclusions	20
References.....	21

List of Acronyms

ABSM	Area-based socioeconomic measure
AHRQ	Agency for Healthcare Research and Quality
AIAN	American Indian and Alaska Native
API	Asian and Pacific Islander
BRFSS	Behavioral Risk Factor Surveillance System
CCAI	Comprehensive Cancer Alliance for Idaho
CDRI	Cancer Data Registry of Idaho
NAACCR	North American Association of Central Cancer Registries
NCHS	National Center for Health Statistics
NHIA	NAACCR Hispanic Identification Algorithm
RMCDs	Rocky Mountain Cancer Data Systems
RUCA	Rural-Urban Commuting Area
SEER	Surveillance, Epidemiology, and End Results Program of the National Cancer Institute
SEER 17	SEER registries covering Alaska Natives, Atlanta (Metropolitan), California excluding SF/SJM/LA, Connecticut, Detroit (Metropolitan), Hawaii, Iowa, Kentucky, Los Angeles, Louisiana, New Jersey, New Mexico, Rural Georgia, San Francisco-Oakland standard metropolitan statistical area, San Jose-Monterey, Seattle (Puget Sound), and Utah.

ATTRIBUTION:

This publication was supported by Cooperative Agreement Number U55/CCU021915 from the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.

SUGGESTED CITATION:

Johnson CJ, Carson SL. *Cancer Disparities in Idaho, Phase I – Incidence: Understanding Disparities in Cancer Incidence Using Individual and Area-Based Measures*. Boise, ID: Cancer Data Registry of Idaho; May 2007.

COPYRIGHT INFORMATION:

All material in this report is in the public domain and may be reproduced or copied without permission.

Abstract

Idaho's comprehensive cancer strategic plan includes overarching goals to reduce health disparities that may exist by race, ethnicity, socioeconomic status, geographic location and other characteristics. Linkages with the Indian Health Service and Northwest Portland Area Indian Health Board, and utilization of the North American Association of Central Cancer Registries (NAACCR) Hispanic Identification Algorithm (NHIA) were used to improve race and ethnicity information collected via medical records. 1996-2004 Idaho resident incident cancer cases were geocoded to Census 2000 tract, and census tract-level area-based socioeconomic measures (ABSMs) were associated with the incidence records. A census tract-level SEERStat database was created to analyze incidence rate variations by individual and tract-level characteristics. Case-level race and ethnicity, tract-level ABSMs, and county-level Behavioral Risk Factor Surveillance System (BRFSS) cancer screening and risk factor prevalence estimates were included in multilevel models to attempt to disentangle individual and area sources of variation in cancer incidence patterns using SAS Proc GLIMMIX. Results from the project will be used by the Comprehensive Cancer Alliance for Idaho (CCAI) to develop strategies to achieve strategic plan objectives.

Introduction

The purpose of this project is to describe and understand disparities in cancer incidence patterns by race and/or ethnicity, census tract-level poverty, urban-rural gradient, and geographic area such that CCAI may develop appropriate prevention and screening strategies. The CCAI Core Steering Committee identified cancer sites for analysis in the Cancer Disparities in Idaho project. The cancer sites selected are consistent with CCAI's priority objectives and are amenable to interventions including cancer screening, diet and physical activity modifications, and smoking cessation. During Phase I of the project, age-adjusted rates for six cancer incidence measures were examined:

- Late stage breast cancer per 100,000 women aged 40+
- Late stage cervical cancer, age 20+
- Late stage colorectal cancer, age 50+
- Lung and bronchus cancer
- Oral cavity and pharynx cancer
- Malignant melanoma of the skin

Methods

Cancer Cases

The Cancer Data Registry of Idaho (CDRI) queried our Rocky Mountain Cancer Data Systems (RMCDS) database for 1996-2004 Idaho resident incident cancer cases and exported a NAACCR V11 confidential layout. CDRI utilized NHIA¹ and linkages with the Indian Health Service and Northwest Portland Area Indian Health Board to improve ethnicity and race information collected via medical records.

Geographic Level of Analysis for Project

The geographic level of analysis for this project was the census tract.² A census tract is a subdivision of a county that contains on average about 4,000 persons. Tract boundaries are drawn such that the population covered is relatively homogenous. Idaho has 280

census tracts (Census 2000). We geocoded address of residence at time of diagnosis and assigned census tract 2000 based on location.

Population Estimates

Annual census tract population sizes by age group, sex, race, and ethnicity were estimated using Census and National Center for Health Statistics (NCHS) bridged-race postcensal population estimates. Bridging methodology developed by NCHS bridges the multiple-race group population counts to single-race categories.^{3,4}

Area-Based Socioeconomic Measures

ABSMs for census tracts were calculated based on Census 2000. The percentage of the population with incomes below federal poverty guidelines was calculated by census tract and tracts were categorized into:

- Less than 5%
- 5% to 9.9%
- 10% to 19.9%
- 20%+ (Federally Designated Poverty Area).

Rural-Urban Commuting Area (RUCA) refers to a census tract-based classification scheme that utilizes the standard Bureau of Census urban area and place definitions in combination with commuting information.⁵ Census tract were categorized into:

- Urban (50,000+ population or 30% or more of residents of census tract commuted to an urban core)
- Large towns (10,000 – 49,999 population and <30% of residents of census tract commuted to an urban core)
- Small rural towns (<10,000 population and <30% of residents of census tract commuted to an urban core).

Urban areas include the Treasure Valley, Pocatello, Idaho Falls, Coeur d'Alene, and the Lewiston area. Large towns include Twin Falls, Burley, Mountain Home, the Moscow area, and some areas adjacent to the Treasure Valley and Idaho Falls. The remainder of the state is designated as small rural towns.

Cancer Screening and Risk Factor Prevalence

County-level screening and risk factor prevalence estimates were generated from 1997-2005 aggregated BRFSS data.⁶

SEER*Stat Database

A census tract-level SEER*Stat database was created to analyze incidence rates by tract-level ABSM characteristics.^{7,8}

Multilevel Modeling of Cancer Incidence Rates

Counts of cancer cases by race and ethnicity were modeled as Poisson random variables in multilevel models with ABSMs at the census tract level and BRFSS risk factor and/or screening prevalence at the county level. Known risk factors and screening behaviors were selected as appropriate for each cancer site. SAS (Version 9.1) Proc GLIMMIX (June 2006 release) was used to run the generalized linear mixed models.^{9,10} Census tract was included as a random effect and race/ethnicity, ABSMs and BRFSS variables as fixed effects. The models were optimized using the Newton-Raphson technique with ridging, starting from generalized linear model estimates. The number of expected cases was calculated by race and ethnicity for each census tract based on age- and sex-specific

rates for Idaho overall and census tract population sizes. The natural log of the number of expected cases was used as an offset variable in the statistical models.

Geographic Information Systems

ESRI ArcView (Version 9.2) was used to create maps of the GLIMMIX results.¹¹

Results

Table 1 shows the statistical significance of individual-level race/ethnicity and area-level poverty and RUCA plus a measure of residual geographic variability for each of the six cancer incidence measures selected for this project. The remainder of the results section is organized by incidence measure and includes graphics for each type of potential disparity, regardless of statistical significance. Evidence of disparities, and the lack thereof, may be useful information for developing strategies to reduce cancer burden in Idaho. In addition, for some cancer incidence measures, there may be meaningful disparities that are not statistically significant due to sparse data. Different ranges of years than 1996-2004 were selected for some cancer incidence measures to ameliorate the potential effects of time trends.

Idaho is comprised of a higher proportion of whites than the US overall (96.4% versus 81.1%), a higher proportion of America Indians and Alaska Natives (AIAN; 1.5% versus 1.1%) and lower proportions of Blacks (0.8% versus 13.1%) and Asian and Pacific Islanders (API; 1.3% versus 4.7%). Idaho's small populations of Blacks (11,055), AIANs (21,846), and APIs (18,155) (2005 NCHS estimates) resulted in small case counts for these groups for some cancer measures and concomitant wide confidence intervals about incidence rate point estimates.

Table 1. Statistical significance of cancer incidence disparities measures in multilevel Poisson regression models (p<0.05 highlighted).

Outcomes	By Race and/or Ethnicity?	By Census Tract Poverty?	By Census Tract RUCA?	By Geographic Location?
Age-Adjusted Incidence Rates of:				
Late stage breast cancer per 100,000 women aged 40+	No	No	No	No
Late stage cervical cancer, age 20+	Yes	No	No	-
Late stage colorectal cancer, age 50+	No	Borderline	Yes	No
Lung and bronchus cancer	Yes	Yes	Yes	Yes
Oral cavity and pharynx cancer	Yes	No	No	No
Malignant melanoma of the skin	Yes	Yes	Yes	Yes

Note: Models produced similar results with or without county-level BRFSS variables; the results above are for models that exclude county-level BRFSS variables.

Late Stage Breast Cancer per 100,000 Women Aged 40+

The incidence of late stage breast cancer among women aged 40 years and older did not vary significantly by individual level race/ethnicity, census tract poverty, census tract RUCA, or geographic location. This measure has been utilized by the Agency for Healthcare Research and Quality (AHRQ) as an indicator for inadequate breast cancer screening. In 2004, Idaho had the lowest rate of mammography among US states.¹² Strategies to improve breast cancer screening statewide are encouraged.

Chart A1 shows age-adjusted rates of late stage breast cancer among women aged 40 and older by race and ethnicity for Idaho and Surveillance, Epidemiology, and End Results (SEER) regions.¹³ Overall, Idaho's rate of late stage breast cancer among women aged 40 and older was slightly less than the SEER rate (not statistically significantly different). In SEER regions, Black women had a significantly higher rate of late stage breast cancer than other race groups, and Hispanic women had a significantly lower rate than non-Hispanic Whites. In Idaho, rates of late stage breast cancer among women aged 40 and older did not differ significantly by race/ethnicity.

Chart A1.

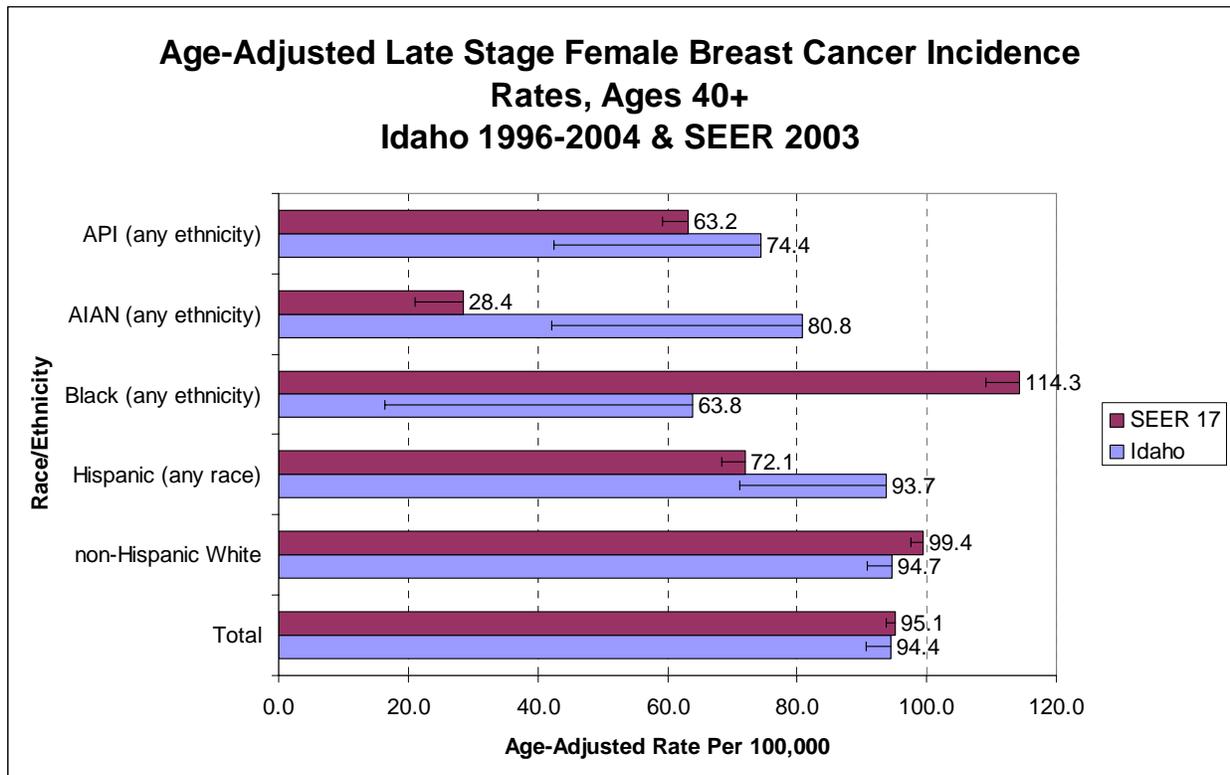


Chart A2 shows age-adjusted rates of late stage breast cancer among women aged 40 and older by census tract poverty category. Rates increased with increasing poverty, but differences were not statistically significant. If each census tract had the same incidence rate of late stage breast cancer among women aged 40 and older as the census tracts in the lowest poverty category, approximately 8.4% of late stage breast cancer cases could have been averted statewide.

Chart A2.

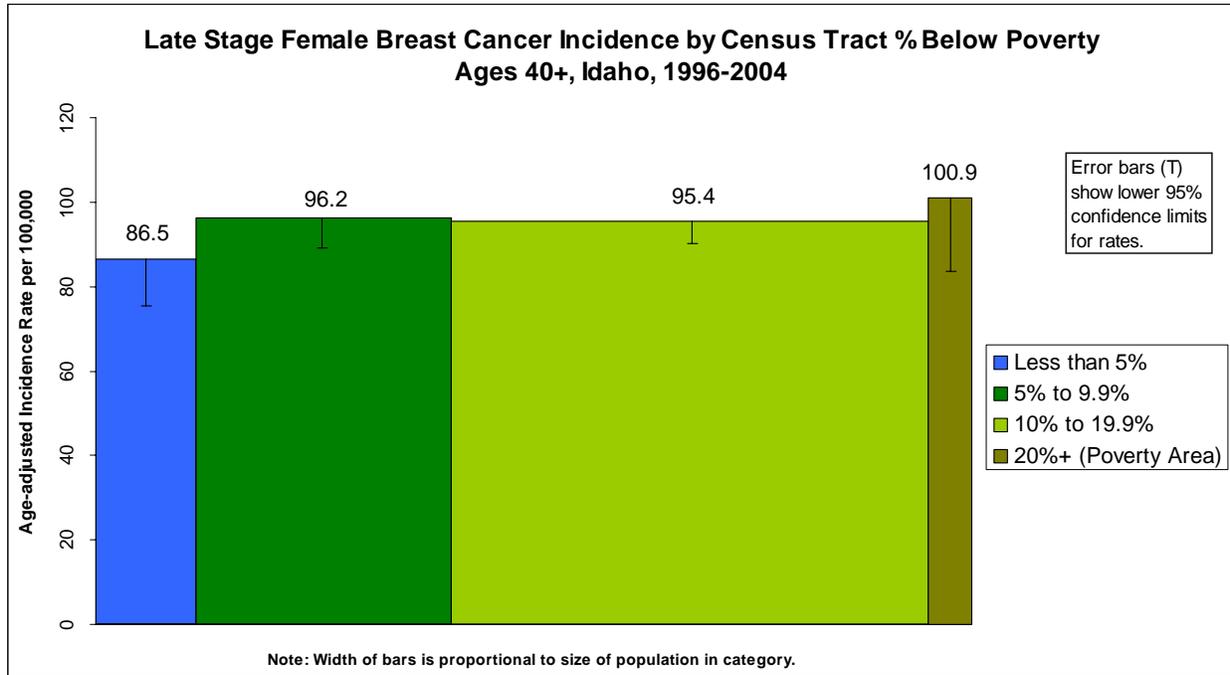
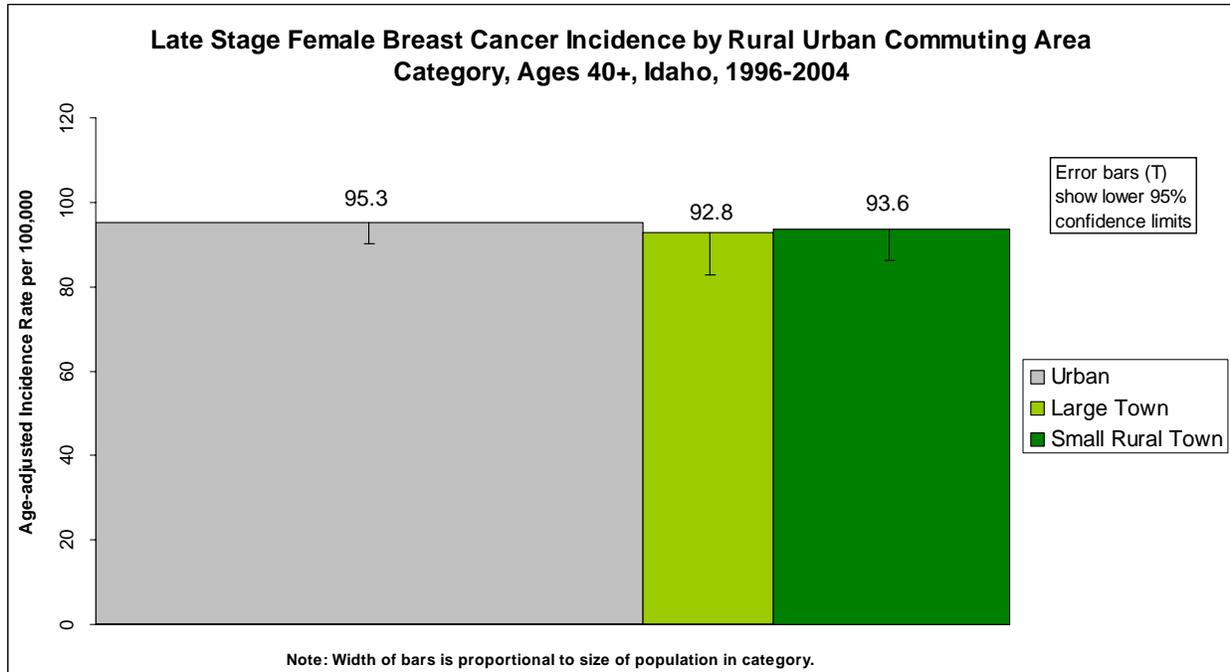


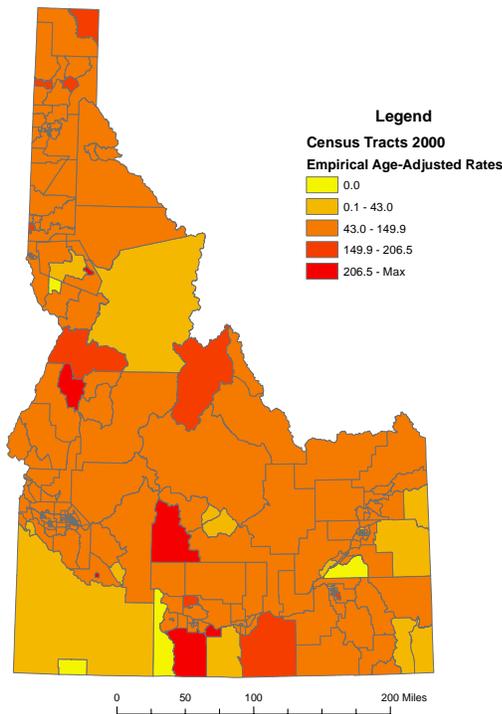
Chart A3 shows age-adjusted rates of late stage breast cancer among women aged 40 and older by RUCA category. Rates did not differ significantly.

Chart A3.



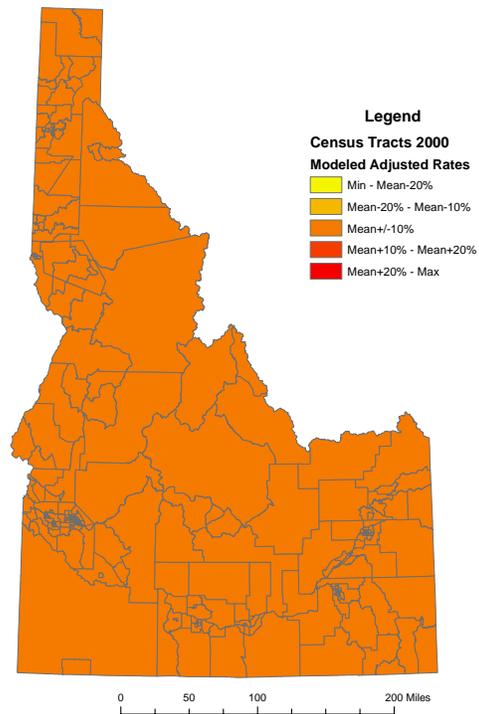
Map A1

Late Stage Female Breast Cancer Incidence
Idaho, 1996-2004



Map A2

Late Stage Female Breast Cancer Incidence
Idaho, 1996-2004



Map A1 shows age-adjusted rates of late stage breast cancer among women aged 40 and older by census tract. Map A2 shows modeled rates adjusting for race/ethnicity, poverty, RUCA category, and county-level breast cancer screening rate. The geographic variability in the empirical rates diminishes after adjusting for individual-level race/ethnicity, census tract-level poverty and RUCA category, and county-level screening; no census tracts had modeled rates that differed by more than 10% from the mean rate for the state.

In general, Maps (A-F)1 may be used to identify areas of the state with higher age-adjusted rates and that may be targeted for screening/prevention activities. Maps (A-F)2 are adjusted for age, race/ethnicity, poverty, RUCA, and county-level cancer screening and risk factor prevalence (as noted). If there were no residual geographic differences after adjusting for these factors, the map would be one color (as is the case for Map A2). This means that differences by race/ethnicity, poverty, RUCA, and county-level screening and risk factor prevalence explain the differences in age-adjusted incidence. Thus, it would be reasonable to target interventions using these variables. Variation in modeled rates in Maps (A-F)2 would not be due to differences in age distribution, race/ethnicity, poverty, RUCA, or county-level screening and risk factor prevalence, but instead due to additional factors that were not measured. These may be local community differences in screening behaviors, for example. This information may be used to target specific communities that may have local norms or customs that are barriers to cancer prevention and control, or inadequate access to screening services.

Late Stage Cervical Cancer, Age 20+

The incidence of late stage cervical cancer among women aged 20 years and older varied statistically significantly by individual level race/ethnicity, but not by census tract poverty, census tract RUCA, or geographic location. This measure has been utilized by the Agency for Healthcare Research and Quality (AHRQ) as an indicator for inadequate cervical cancer screening. In 2004, Idaho had the second lowest rate of Pap test utilization among US states.¹² Strategies to improve cervical cancer screening statewide are encouraged. In addition, specific strategies to target Hispanic women and other minority women are warranted.

Chart B1 shows age-adjusted rates of late stage cervical cancer among women aged 20 and older by race and ethnicity for Idaho and SEER regions.¹³ Idaho's rates of late stage cervical cancer among women aged 20 and older were significantly less than the SEER rates, overall and for non-Hispanic Whites. Idaho's rates did not differ significantly from SEER rates for other race/ethnicity groups. Hispanic women had the highest rates of late stage cervical cancer in Idaho and in SEER regions. In Idaho, the rate of late stage cervical cancer among women aged 20 and older was more than three times higher among Hispanic women than among non-Hispanic Whites.

Chart B1.

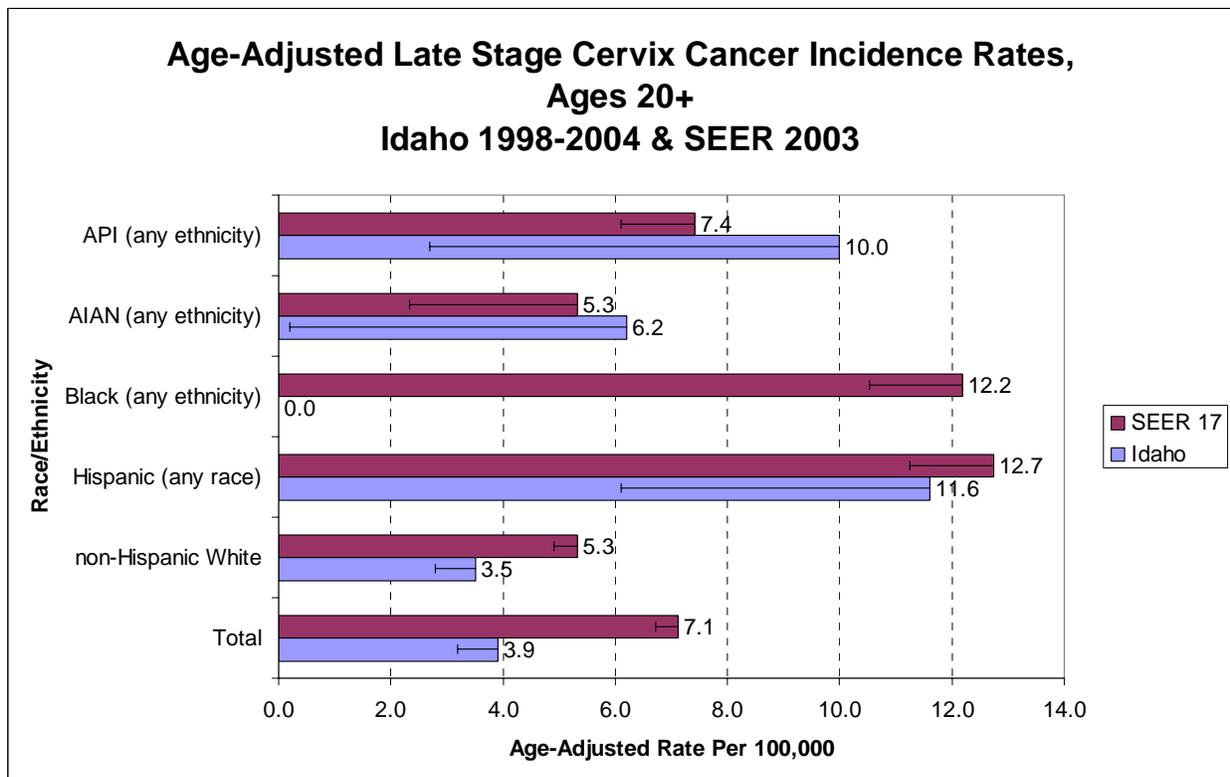


Chart B2 shows age-adjusted rates of late stage cervical cancer among women aged 20 and older by census tract poverty category. Rates did not differ significantly.

Chart B2.

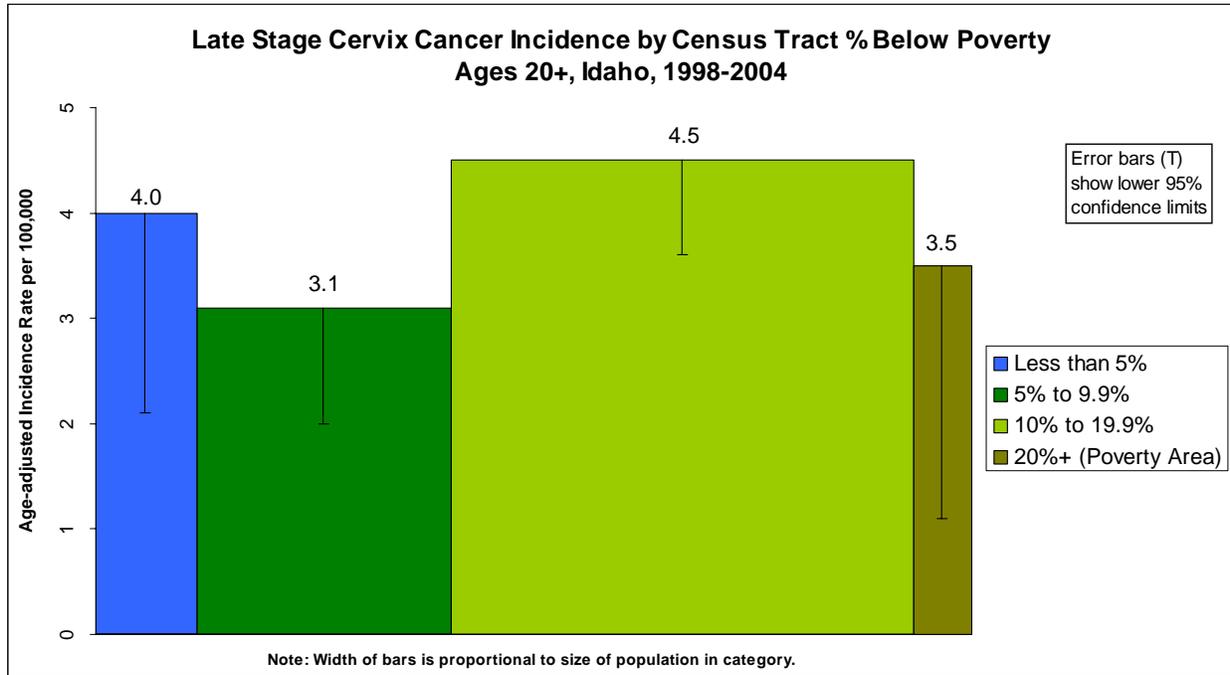
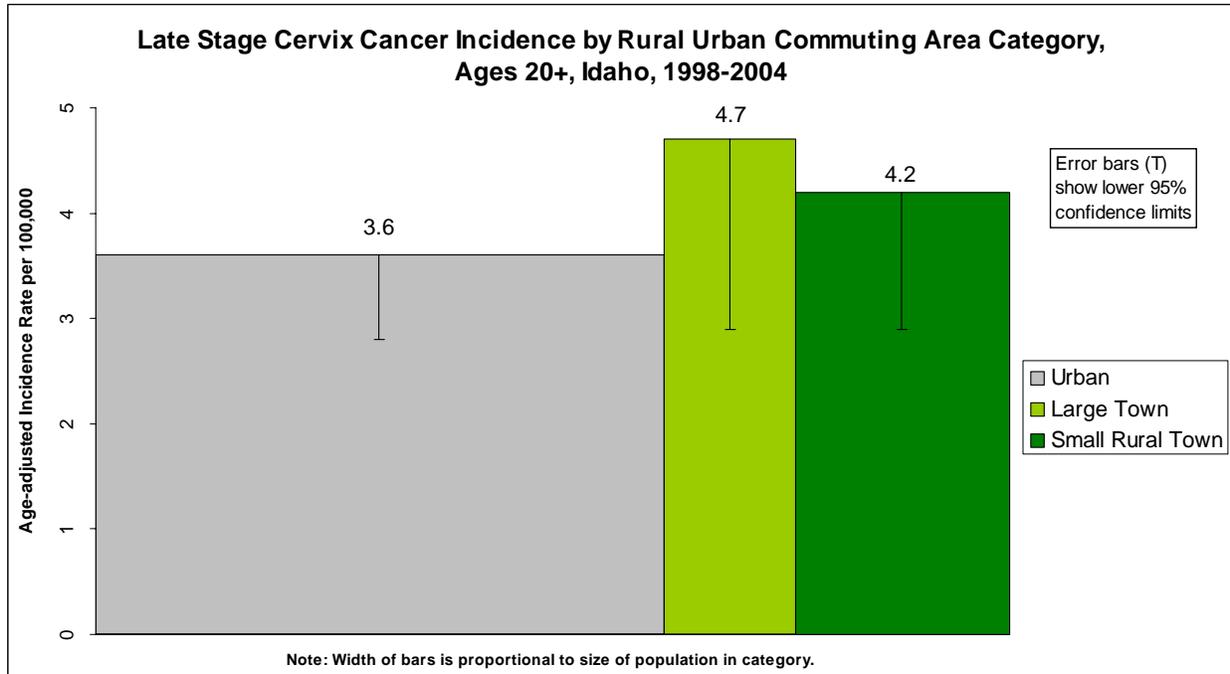


Chart B3 shows age-adjusted rates of late stage cervical cancer among women aged 20 and older by RUCA category. Rates did not differ significantly.

Chart B3.



Due to the sparseness of the data for late stage cervical cancer among women aged 20 and older (123 cases 1998-2004 among 280 census tracts), maps were not created.

Late Stage Colorectal Cancer, Age 50+

The incidence of late stage colorectal cancer among persons aged 50 years and older differed borderline statistically significantly by census tract poverty, significantly by census tract RUCA, but not by individual level race/ethnicity or geographic location. This measure has been utilized by the Agency for Healthcare Research and Quality (AHRQ) as an indicator for inadequate colorectal cancer screening. In 2004, Idaho ranked 42nd among states in terms of the proportion of persons aged 50 and older who ever had a sigmoidoscopy or colonoscopy.¹² Strategies to improve colorectal cancer screening statewide are encouraged.

Chart C1 shows age-adjusted rates of late stage colorectal cancer among persons aged 50 years and older by race and ethnicity for Idaho and SEER regions.¹³ Overall, Idaho's rate of late stage colorectal cancer among persons aged 50 years and older was significantly lower than the SEER rate. In SEER regions, Blacks had a significantly higher rate of late stage colorectal cancer than other race groups, and Hispanics had a significantly lower rate than non-Hispanic Whites. In Idaho, Hispanics had numerically the highest rate of late stage colorectal cancer among persons aged 50 years and older (not statistically significant).

Chart C1.

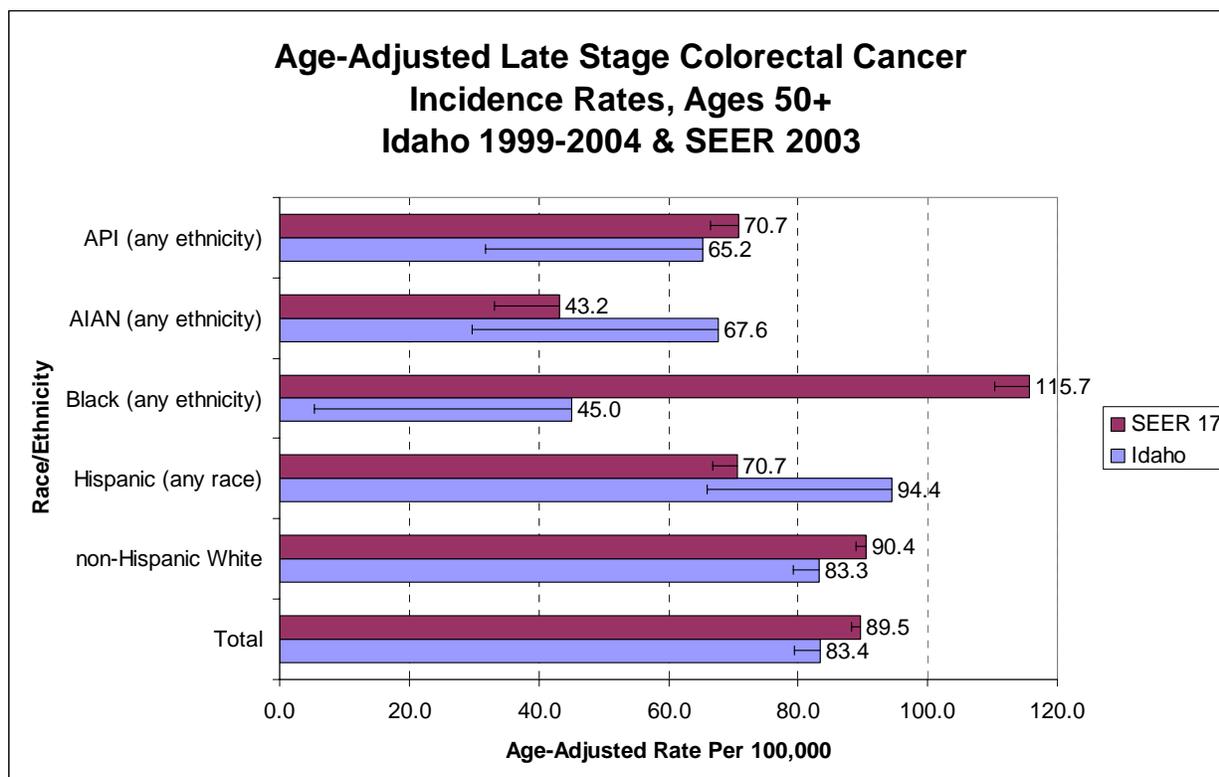


Chart C2 shows age-adjusted rates of late stage colorectal cancer among persons aged 50 years and older by census tract poverty category. Rates generally increased with increasing poverty. If each census tract had the same incidence rate of late stage colorectal cancer among persons aged 50 years and older as the census tracts in the lowest poverty category, approximately 4.3% of late stage colorectal cancer cases could have been averted statewide.

Chart C2.

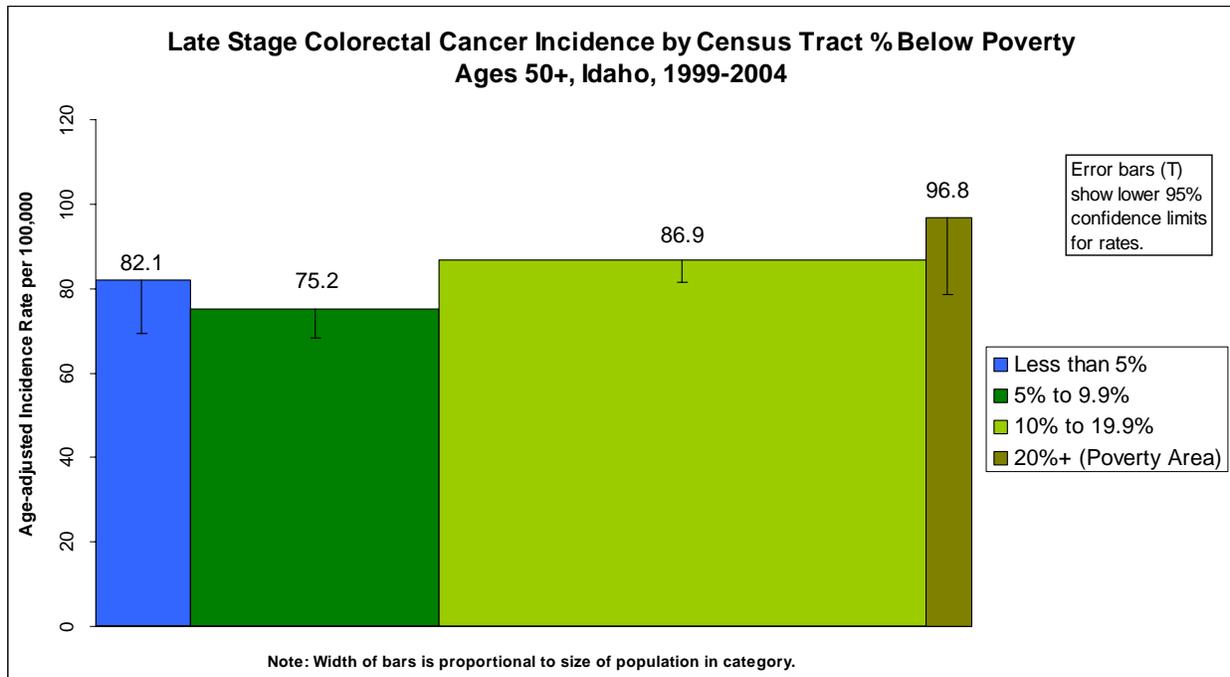
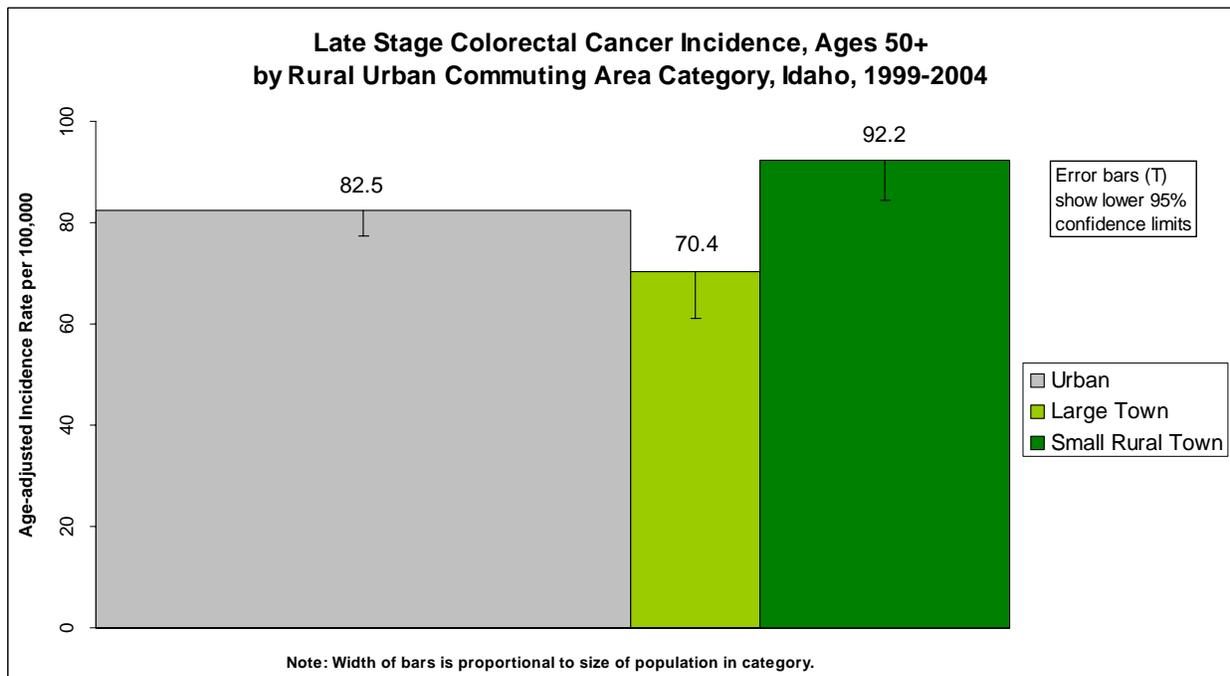


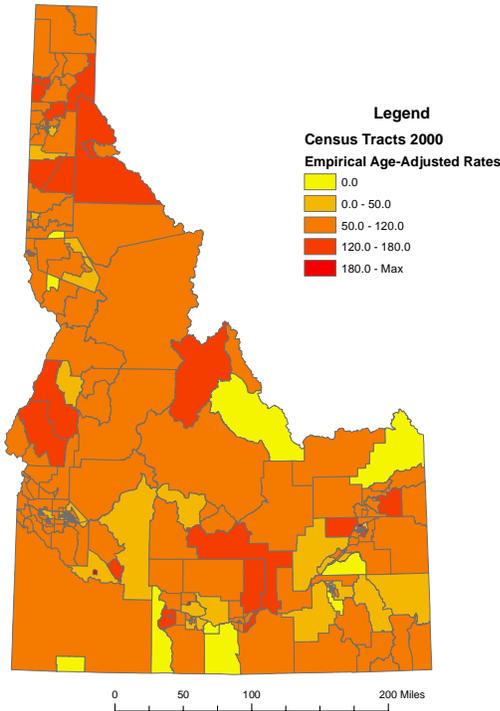
Chart C3 shows age-adjusted rates of late stage colorectal cancer among persons aged 50 years and older by RUCA category. The rate was lowest for residents of large towns, and highest for residents of small rural towns.

Chart C3.



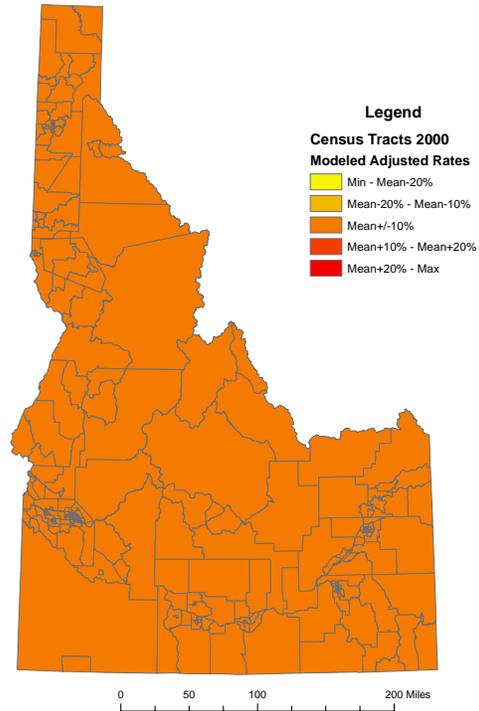
Map C1

Late Stage Colorectal Cancer Incidence
Ages 50+, Idaho, 1999-2004



Map C2

Late Stage Colorectal Cancer Incidence
Ages 50+, Idaho, 1999-2004



Map C1 shows age-adjusted rates of late stage colorectal cancer among persons aged 50 years and older by census tract. Map C2 shows modeled rates adjusting for race/ethnicity, poverty, RUCA category, and county-level colorectal cancer screening prevalence. Much of the geographic variability in the empirical rates diminishes after adjusting for individual-level race/ethnicity, census tract-level poverty and RUCA category, and county-level colorectal cancer screening prevalence; no census tracts had modeled rates that differed by more than 10% from the mean rate for the state.

Lung and Bronchus Cancer

The incidence of lung and bronchus cancer differed statistically significantly by individual level race/ethnicity, census tract poverty and RUCA, and geographic location. Nearly 90% of lung and bronchus cancer cases are attributable to smoking.¹⁴ In 2005, Idaho ranked 7th among states in terms of the proportion of persons aged 18 and older who currently smoked tobacco.¹⁵ Nonetheless, lung and bronchus cancer is the number one cause of cancer deaths among both men and women. Strategies to reduce smoking prevalence statewide are encouraged.

Chart D1 shows age-adjusted rates of lung and bronchus cancer by race and ethnicity for Idaho and SEER regions.¹³ Overall, Idaho's rate of lung and bronchus cancer was significantly lower than the SEER rate. In Idaho and SEER regions, Blacks had the highest rates of lung cancer, followed by non-Hispanic Whites.

Chart D1.

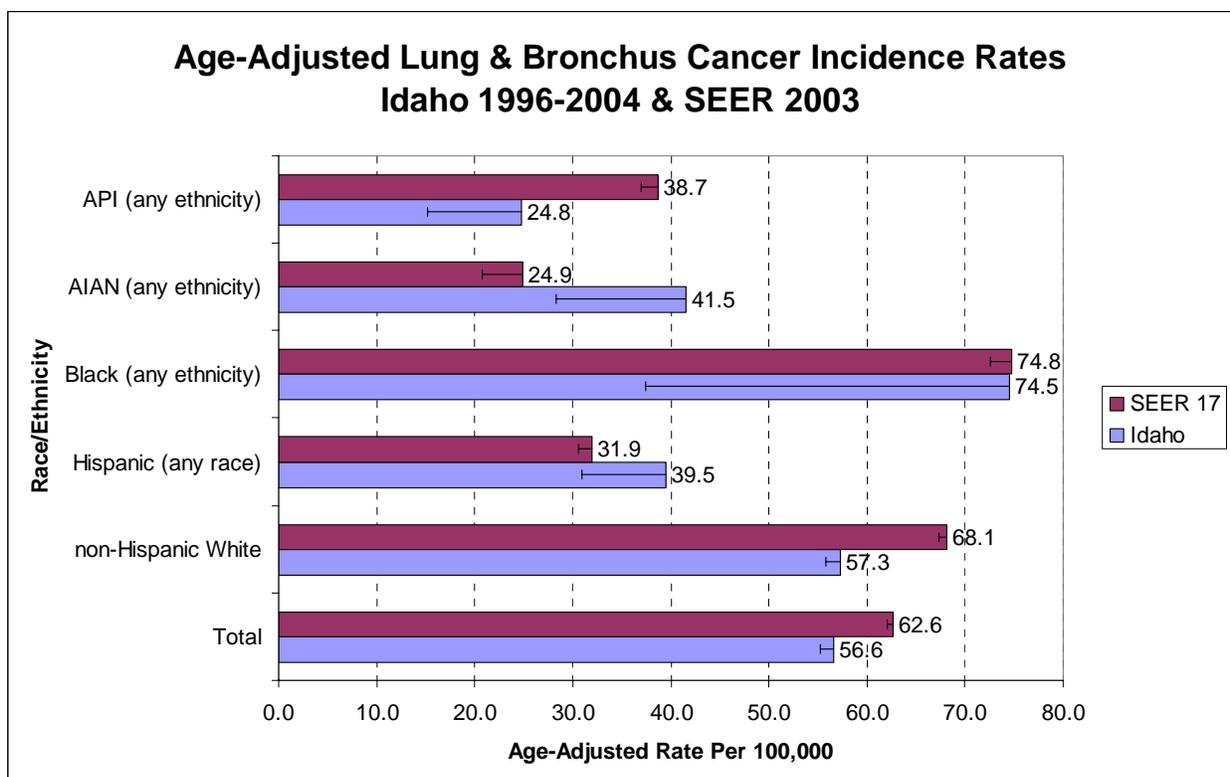


Chart D2 shows age-adjusted rates of lung and bronchus cancer by census tract poverty category. Rates generally increased with increasing poverty. If each census tract had the same incidence rate of lung and bronchus cancer as the census tracts in the lowest poverty category, approximately 4.4% of lung and bronchus cancer cases could have been averted statewide.

Chart D2.

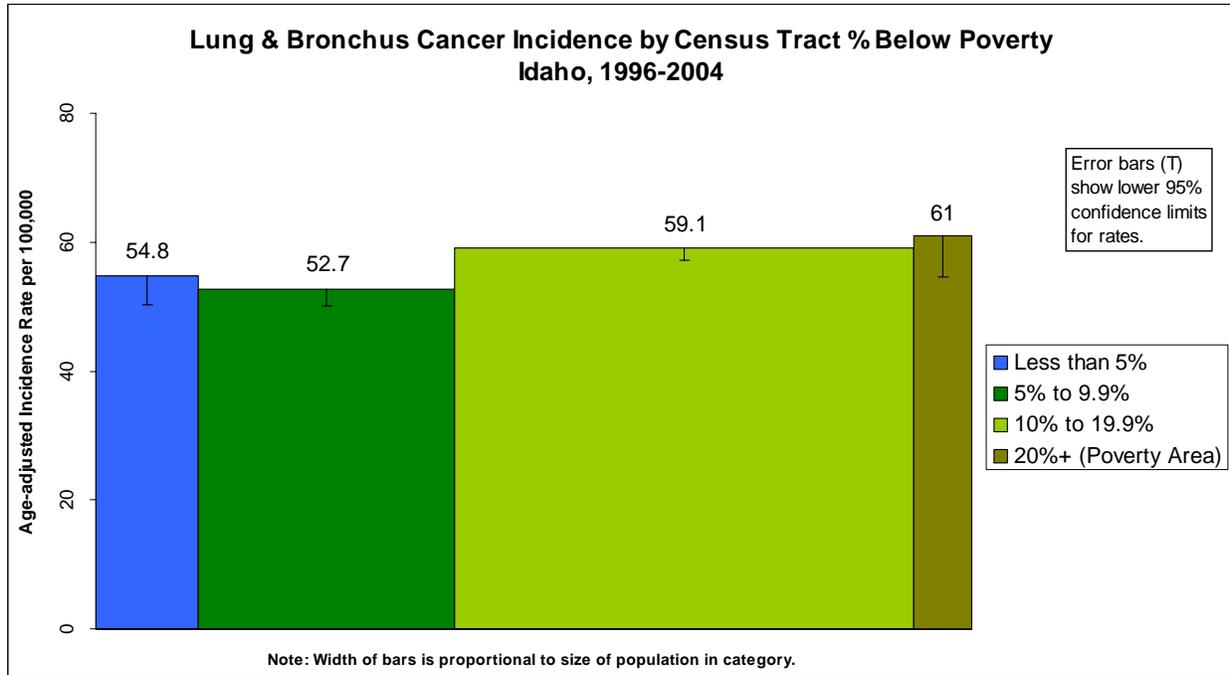
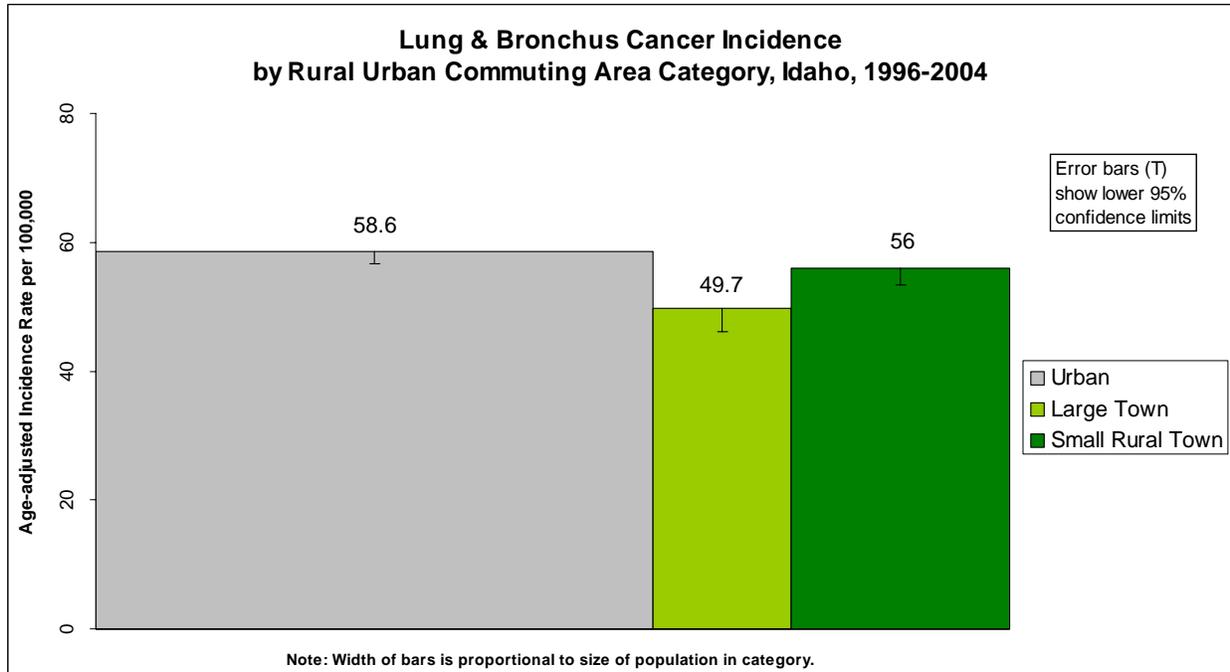


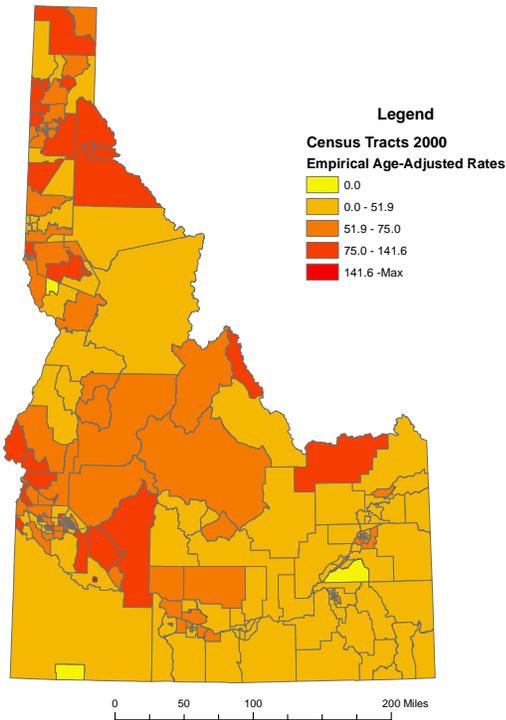
Chart D3 shows age-adjusted rates of lung and bronchus cancer by RUCA category. The rate was lowest for residents of large towns, and highest for residents of urban areas.

Chart D3.



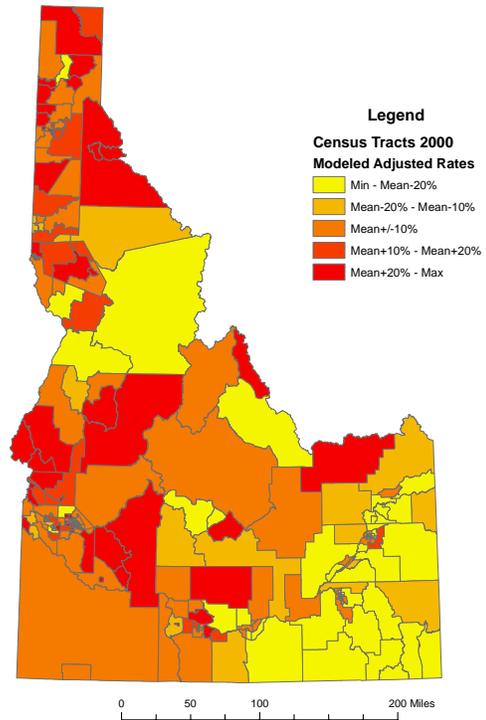
Map D1

Lung Cancer Incidence
Idaho, 1996-2004



Map D2

Lung Cancer Incidence
Idaho, 1996-2004



Map D1 shows age-adjusted rates of lung and bronchus cancer by census tract. Map D2 shows modeled rates adjusting for race/ethnicity, poverty, and RUCA category. The modeled rates are highly heterogeneous. Adding county-level BRFSS current smoking prevalence estimates did little to reduce the geographic variability and made it more difficult to target geographic areas for intervention. Map D2 may be used to identify geographic areas of Idaho where particular emphasis may be placed on decreasing smoking prevalence.

Oral Cavity and Pharynx Cancer

The incidence of oral cavity and pharynx cancer differed significantly by individual level race/ethnicity, but not by census tract poverty, census tract RUCA, or geographic location. Smoking and spit tobacco are major risk factors for cancers of the oral cavity and pharynx.¹⁶ Combined exposure to tobacco and alcohol multiply the risks of each other.¹⁶ It is estimated that smoking tobacco and drinking alcohol account for 75% of all oral cancers in the United States.¹⁶

Chart E1 shows age-adjusted rates of oral cavity and pharynx cancer by race and ethnicity for Idaho and SEER regions.¹³ Overall, Idaho's rate of oral cavity and pharynx cancer was higher than the SEER rate (not statistically significant). In SEER regions, Blacks had the highest rate of oral cavity and pharynx cancer, followed by non-Hispanic Whites. In Idaho, non-Hispanic Whites had the highest rates of oral cavity and pharynx cancer, followed by Hispanics. Asian and Pacific Islanders had significantly lower rates of oral cavity and pharynx cancer in Idaho and SEER regions.

Chart E1.

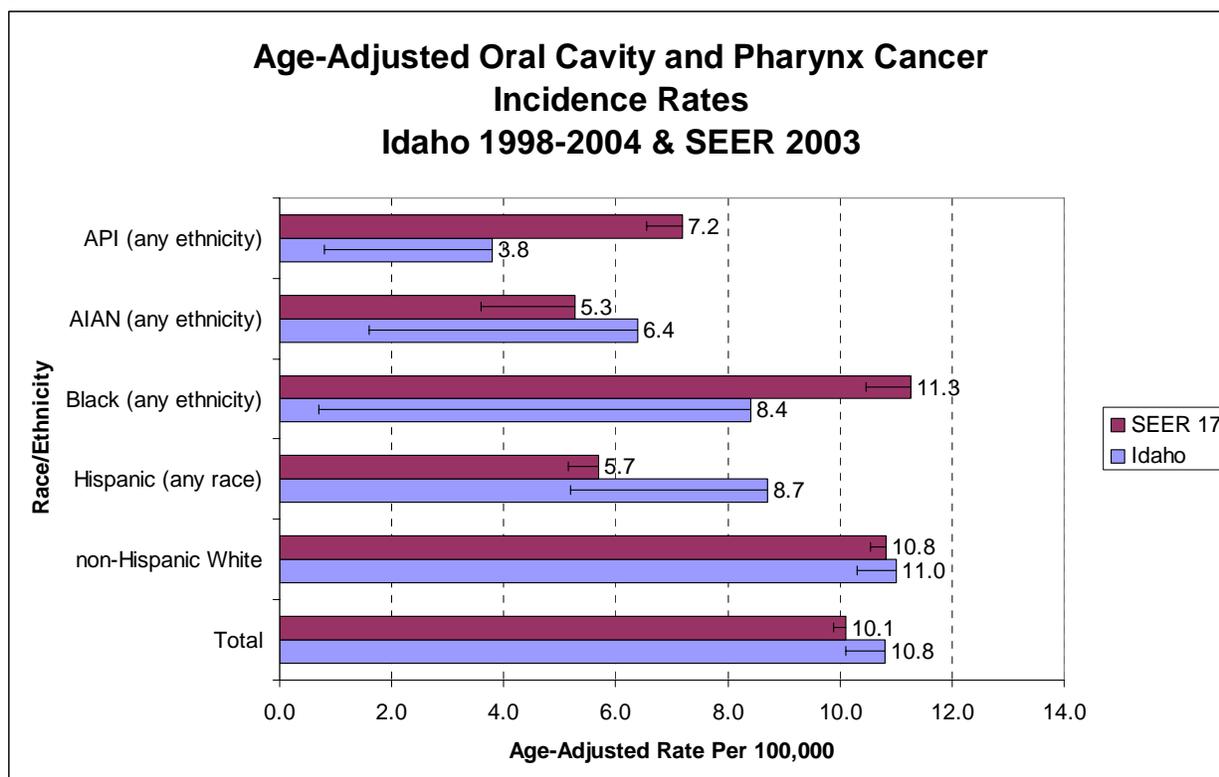


Chart E2 shows age-adjusted rates of oral cavity and pharynx cancer by census tract poverty category. Rates generally increased with increasing poverty. If each census tract had the same incidence rate of oral cavity and pharynx cancer as the census tracts in the lowest poverty category, approximately 28.1% of oral cavity and pharynx cancer cases could have been averted statewide.

Chart E2.

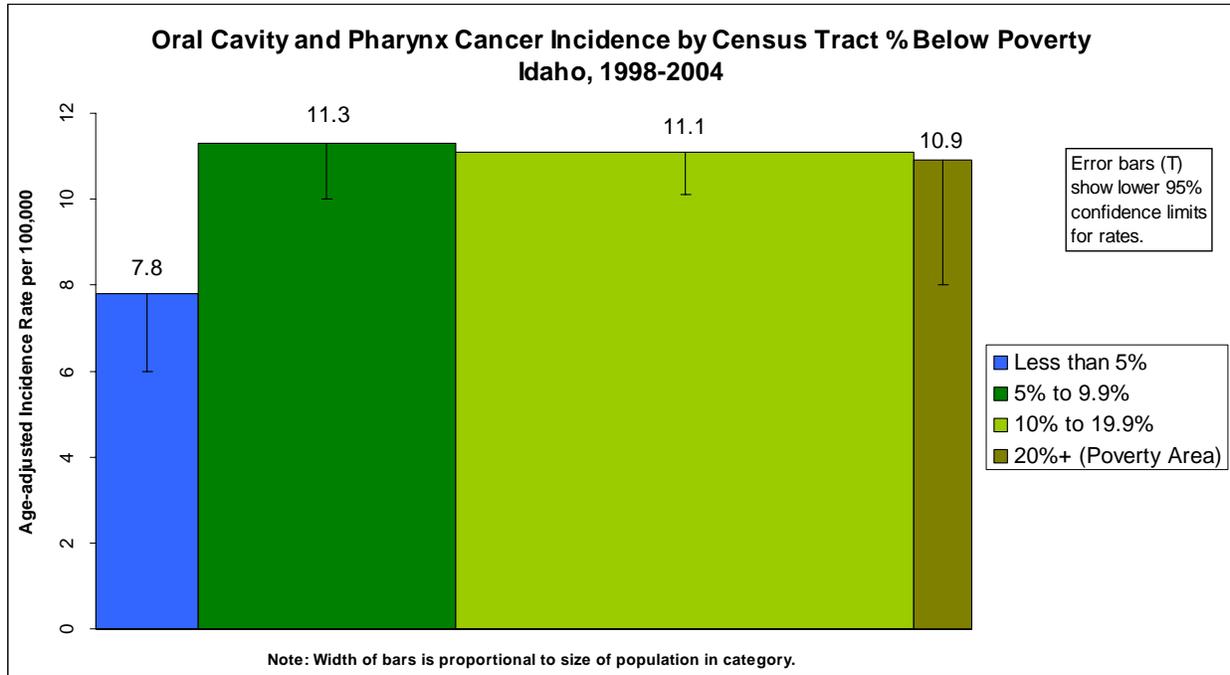
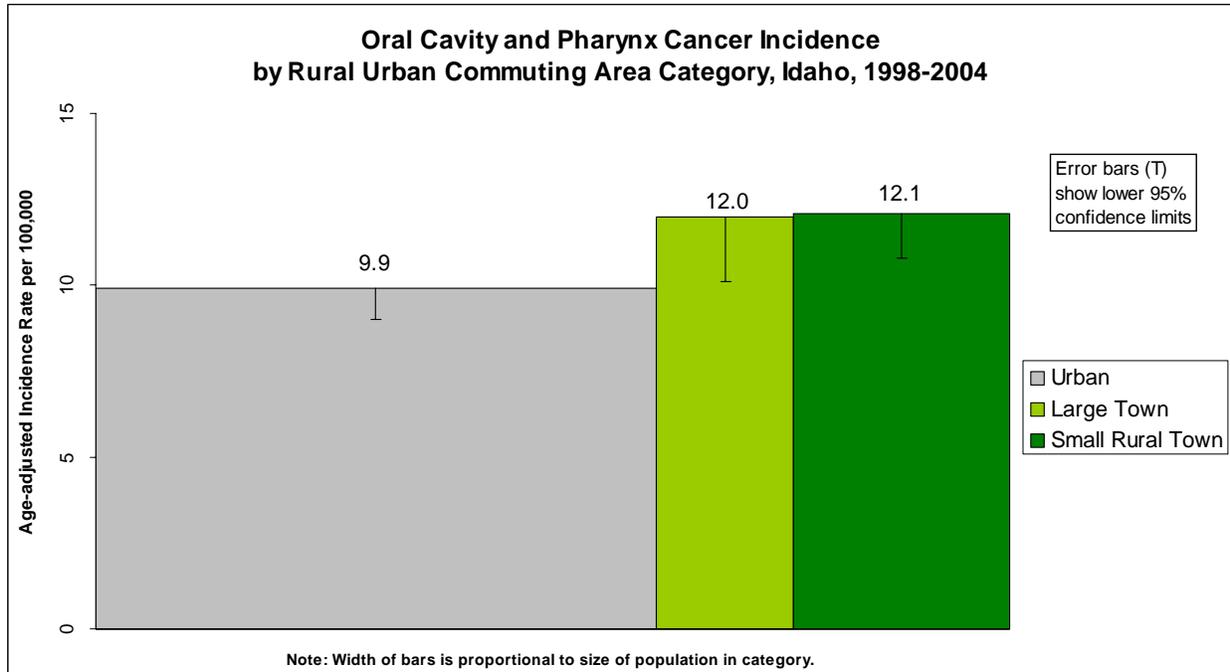


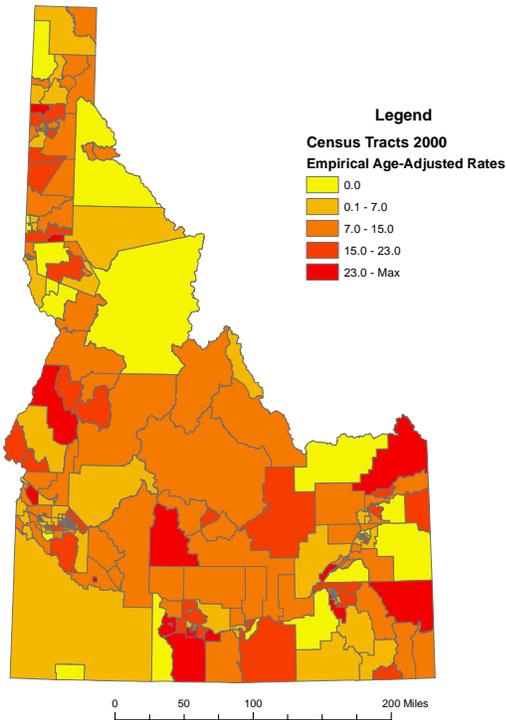
Chart E3 shows age-adjusted rates of oral cavity and pharynx cancer by RUCA category. The rate was lowest for residents of urban areas, and highest for residents of small rural towns.

Chart E3.



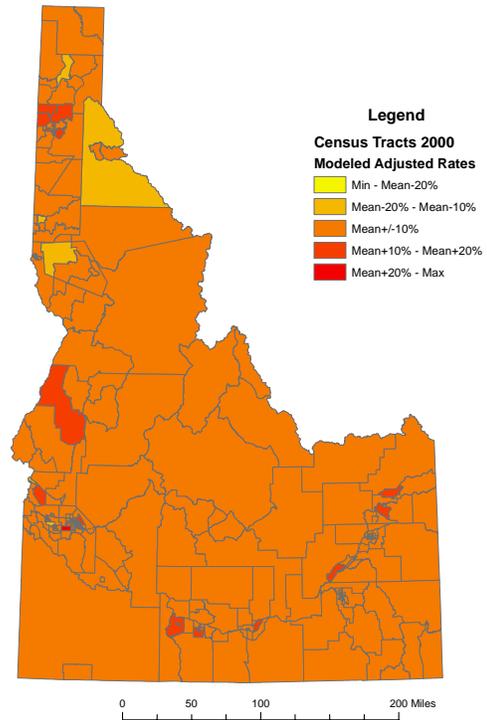
Map E1

Oral Cavity and Pharynx Cancer Incidence
Idaho, 1998-2004



Map E2

Oral Cavity and Pharynx Cancer Incidence
Idaho, 1998-2004



Map E1 shows age-adjusted rates of oral cavity and pharynx cancer by census tract. Map E2 shows modeled rates adjusting for race/ethnicity, poverty, RUCA category, and county-level smoking prevalence. Much of the geographic variability in the empirical rates diminishes after adjusting for individual-level race/ethnicity, census tract-level poverty and RUCA category, and county-level smoking prevalence. The residual variability in census tract rates may be related to spit tobacco use.

Malignant Melanoma of the Skin

The incidence of malignant melanoma of the skin differed significantly by individual level race/ethnicity, census tract poverty, census tract RUCA, and geographic location. Ultraviolet light exposure, especially during childhood, is a major risk factor.¹⁷ Incidence of malignant melanoma of the skin is highest among Caucasians and uncommon among Blacks.¹⁸ Intermittent exposure to ultraviolet radiation (e.g. white collar workers who vacation at the beach) has been shown to be a greater risk than chronic exposure.¹⁹

Chart F1 shows age-adjusted rates of malignant melanoma of the skin by race and ethnicity for Idaho and SEER regions.¹³ Overall, Idaho's rate of malignant melanoma of the skin was significantly higher than the SEER rate, owing mostly to the higher proportion of the population that is White in Idaho. Among non-Hispanic Whites, Idaho's rate of malignant melanoma of the skin was significantly lower than the SEER rate. Among Hispanics, Asian and Pacific Islanders, and American Indian and Alaska Natives, rates of malignant melanoma of the skin were higher in Idaho than in SEER regions, although the difference was statistically significant only for American Indian and Alaska Natives.

Chart F1.

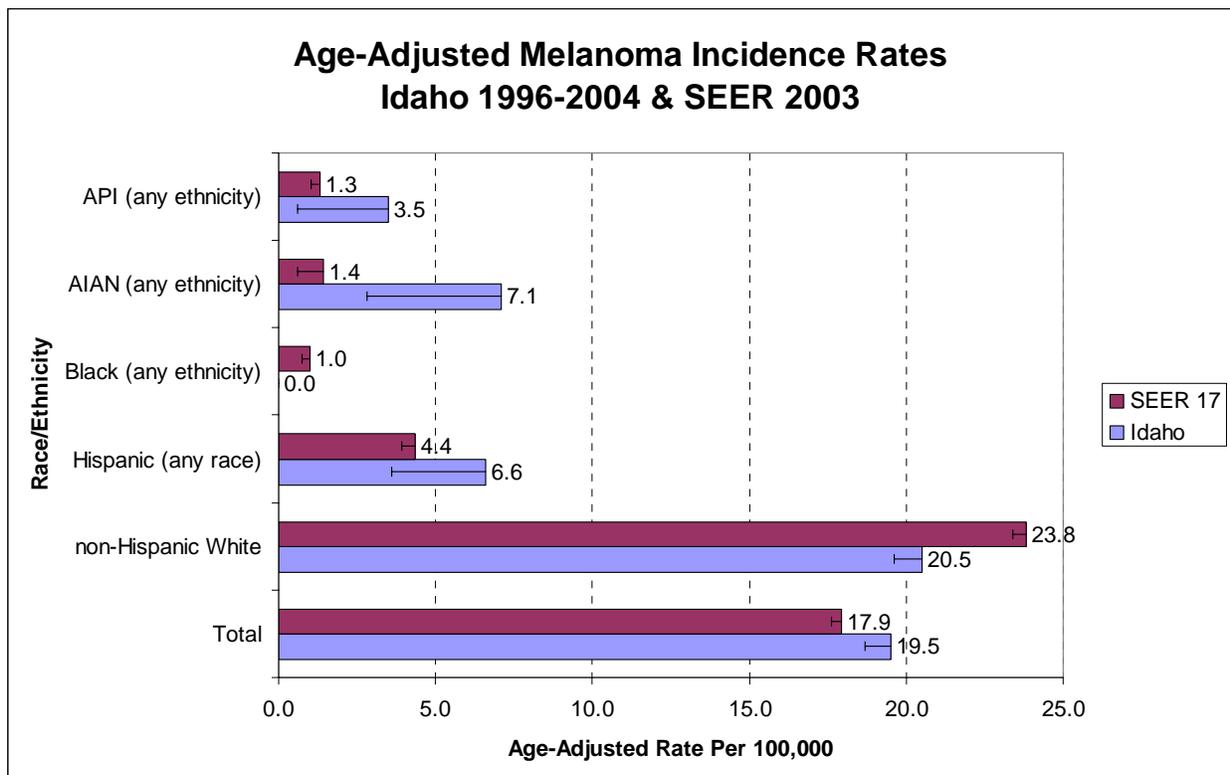


Chart F2 shows age-adjusted rates of malignant melanoma of the skin by census tract poverty category. Rates decreased monotonically with increasing poverty.

Chart F2.

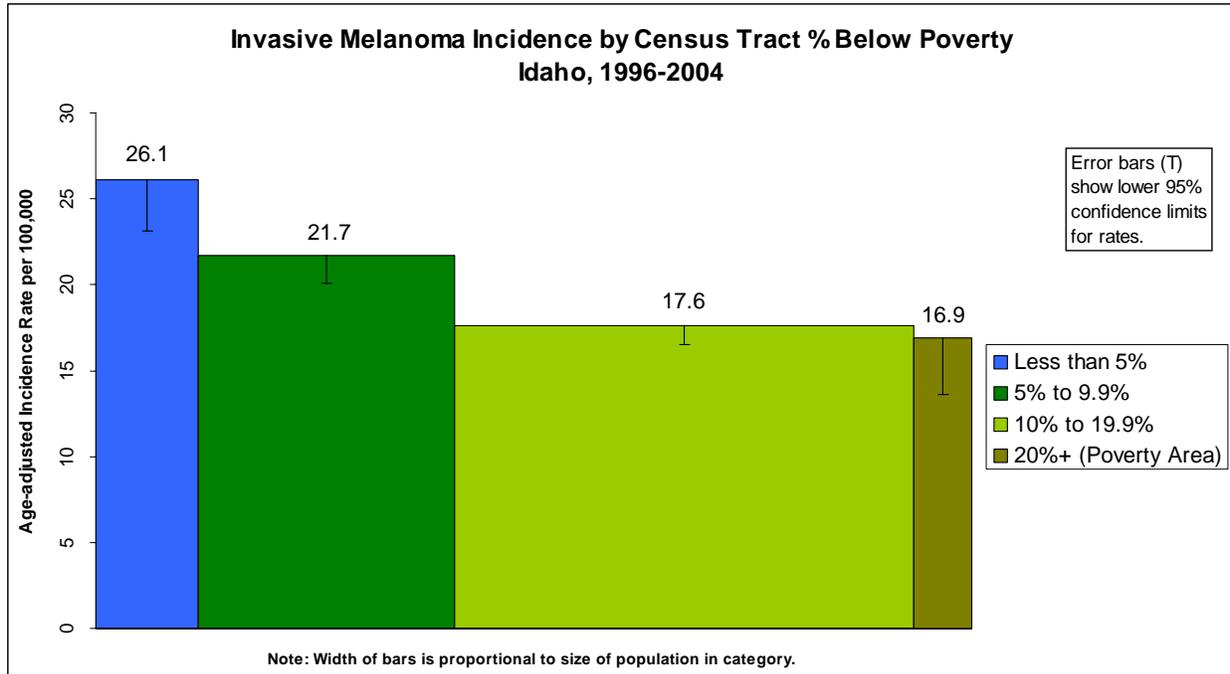
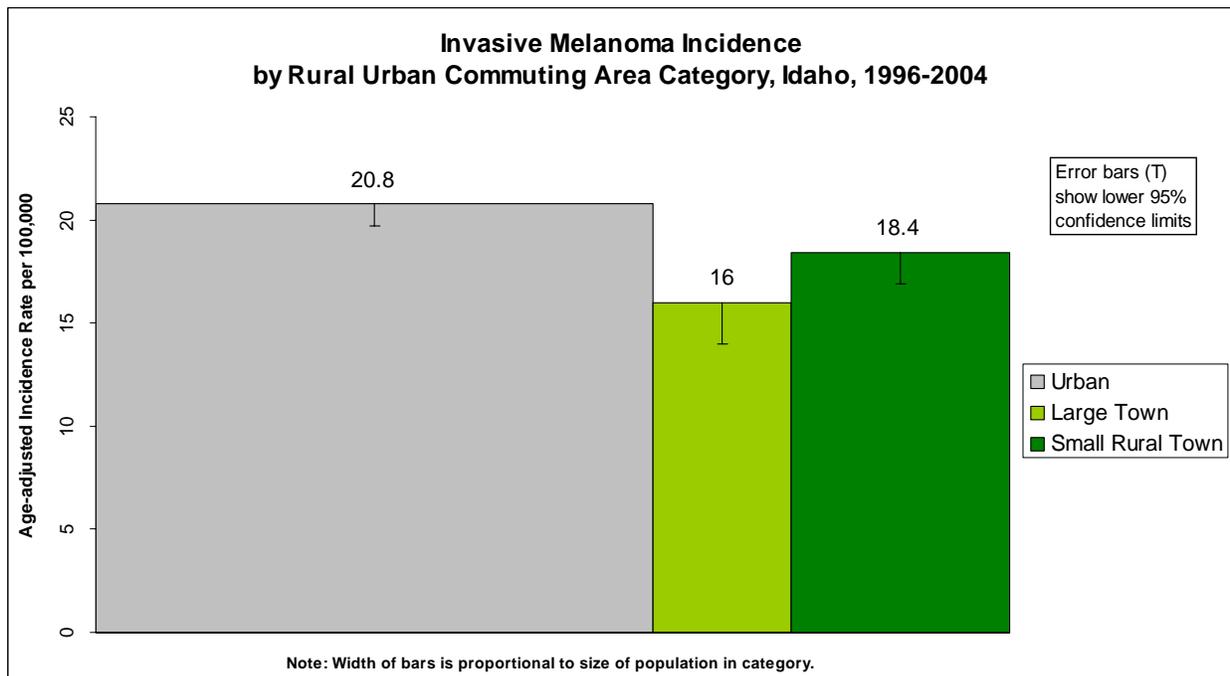
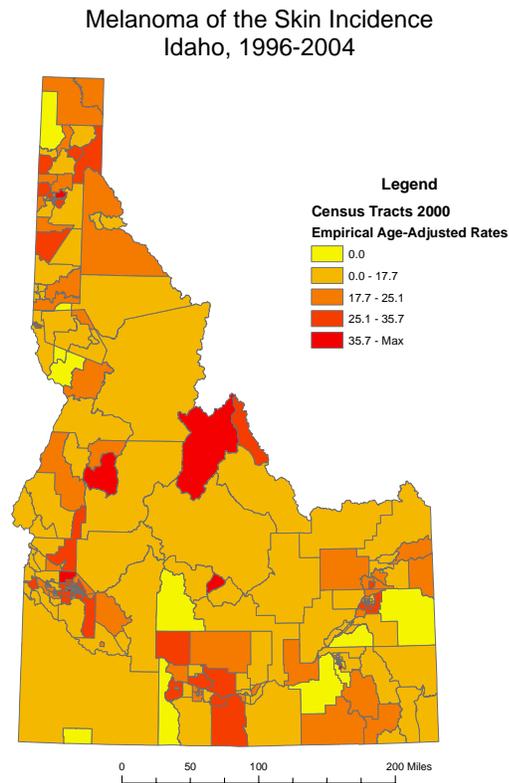


Chart F3 shows age-adjusted rates of malignant melanoma of the skin by RUCA category. The rate was highest for residents of urban areas, and lowest for residents of large towns.

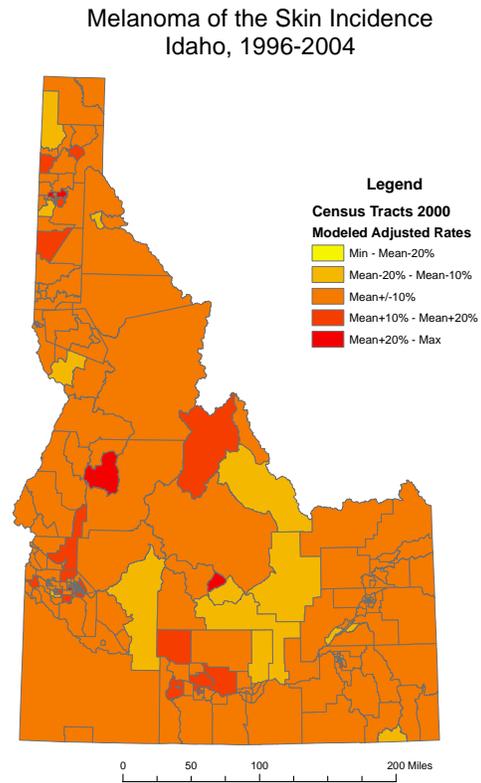
Chart F3.



Map F1



Map F2



Map F1 shows age-adjusted rates of malignant melanoma of the skin by census tract. Map F2 shows modeled rates adjusting for race/ethnicity, poverty, and RUCA category. Much of the geographic variability in the empirical rates diminishes after adjusting for individual-level race/ethnicity and census tract-level poverty and RUCA category. Map F2 may be used to identify geographic areas of Idaho where particular emphasis may be placed on skin cancer prevention.

Conclusions

Significant disparities in cancer incidence patterns exist in Idaho by race and ethnicity and census tract-level contextual variables. By analyzing cancer incidence using multilevel regression models, we attempted to disentangle individual and area-level sources of variation. It is hoped that these results may be used to develop strategies to target appropriate populations for cancer prevention and screening. It is important to note that the specific sub-populations that have been identified as having higher cancer incidence rates are not the same for all cancer sites studied. Different approaches will need to be employed depending on the cancer site targeted. The next phases of the Cancer Disparities in Idaho project will focus on treatment patterns and cancer survival.

References

1. NAACCR Latino Research Work Group. *NAACCR Guideline for Enhancing Hispanic/Latino Identification: Revised NAACCR Hispanic/Latino Identification Algorithm [NHIA v2]*. Springfield (IL): North American Association of Central Cancer Registries. September 2005.
2. Krieger N, Chen JT, Waterman PD, Soobader MJ, Subramanian SV, Carson R. *Geocoding and monitoring of US socioeconomic inequalities in mortality and cancer incidence: does the choice of area-based measure and geographic level matter?: The Public Health Disparities Geocoding Project*. *Am J Epidemiol* 2002; 156:471-482.
3. Ingram DD, Parker JD, Schenker N, Weed JA, Hamilton B, Arias E, Madans JH. *United States Census 2000 population with bridged race categories*. *Vital Health Stat* 2003; 2(135). Hyattsville, Maryland: National Center for Health Statistics. Available from: http://www.cdc.gov/nchs/data/series/sr_02/sr02_135.pdf
4. Parker JD, Schenker N, Ingram DD, Weed JA, Heck KE, Madans JH. *Bridging between two standards for collecting information on race and ethnicity: an application to Census 2000 and vital rates*. *Public Health Reports* 2004; 119(2):192-205.
5. Morrill R, Cromartie J, Hart G. *Metropolitan, Urban, and Rural Commuting Areas: Toward a Better Depiction of the United States Settlement System*. *Urban Geography* 1999; 20:727-748. RUCA codes and data accessed from <http://151.121.68.30/Data/RuralUrbanCommutingAreaCodes/>.
6. Aggregated Idaho Behavioral Risk Factor Surveillance System dataset provided by Teresa Abbott, Idaho Department of Health and Welfare, August 2006.
7. SEER*Prep version 2.3.5. Produced by Information Management Services, Inc. (Silver Spring, MD) in consultation with the SEER Program of the National Cancer Institute: <http://seer.cancer.gov/seerprep/>.
8. Surveillance Research Program, National Cancer Institute SEER*Stat software version 6.2.4: <http://www.seer.cancer.gov/seerstat>.
9. SAS version 9.1.3. SAS Institute Inc. (Cary, NC).
10. SAS GLIMMIX Procedure, June 2006 release. Accessed from: <http://support.sas.com/rnd/app/da/glimmix.html>.
11. ESRI ArcMap 9.2. ESRI Inc. (Redlands, CA).
12. *Idaho Behavioral Risk Factors: Results From the 2004 Behavioral Risk Factor Surveillance System*. Boise: Idaho Department of Health and Welfare, Division of Health, Bureau of Health Policy and Vital Statistics, 2005. National data accessed from <http://www.cdc.gov/brfss/>.
13. Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: *Incidence - SEER 17 Regs Public-Use, Nov 2005 Sub (2000-2003) - Linked To County Attributes - Total U.S., 1969-2003 Counties*, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2006, based on the November 2005 submission.
14. Thun MJ, Day-Lally C, Myers DG, Calle EE, Flanders WD, Zhu B-P, Namboodiri MM, Heath CW Jr. *Trends in tobacco smoking and mortality from cigarette use in Cancer Prevention Studies I (1959 through 1965) and II (1982 through 1988)*. In: Shoptland DR, Burns DM, Garfinkel L, Samet JM, editors. *Changes in Cigarette-Related Disease Risks and Their Implication for Prevention and Control*. Smoking and Tobacco Control Monograph No. 8. Rockville (MD): U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute, 1997a:305-82. NIH Publication No. 97-4213.
15. *Idaho Behavioral Risk Factors: Results From the 2005 Behavioral Risk Factor Surveillance System*. Boise: Idaho Department of Health and Welfare, Division of Health, Bureau of Health Policy and Vital Statistics, 2006. National data accessed from <http://www.cdc.gov/brfss/>.
16. Blot WJ, McLaughlin JK, Winn DM, et al. *Smoking and drinking in relation to oral and pharyngeal cancer*. *Cancer Res* 1988; 48:3282-3287.
17. Armstrong BK, Kricger A. *The epidemiology of UV induced skin cancer*. *J Photochem Photobiol B* 2001 Oct; 63(1-3):8-18.
18. Eide MJ, Weinstock MA. *Association of UV index, latitude, and melanoma incidence in nonwhite populations--US Surveillance, Epidemiology, and End Results (SEER) Program, 1992 to 2001*. *Arch Dermatol* 2005 Apr;141(4):477-481.
19. Walter SD, King WD, Marrett LD. *Association of cutaneous malignant melanoma with intermittent exposure to ultraviolet radiation: results of a case-control study in Ontario, Canada*. *Int J Epidemiol* 1999; 28:418-427.