RESEARCH

Patterns of Cancer Related Health Disparities in Arizona

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ABSTRACT

Cancer incidence rates vary regionally among American Indians (AIs) and Latinos. The goal of this was to identify areas of research necessary to reduce cancer health disparities in AIs and Latinos, the two major racial/ethnic minority groups in Arizona. In an effort to better understand cancer health disparities, cancer incidence rates in AIs and Latinos in Arizona were compared to non-Hispanic Whites (NHWs). Age-adjusted incidence rates (per 100,000) were obtained from the Arizona Cancer Registry and the North American Association of Central Cancer Registries. Spearman's rank test was used to examine correlation between county-level cancer incidence rates and socio-demographic factors. AIs and Latinos had lower incidence rates of screening for detectable cancers than NHWs. Among older men (age ≥65), however, AIs and Latinos had similar prostate cancer incidence rates to NHWs. Some of less common cancers, such as kidney, stomach, liver, and gallbladder, were more frequently diagnosed in AIs and Latinos than NHWs. AIs and Latinos were more likely to be diagnosed with advanced cancer stage, except for cervical cancer. Correlations between prostate and breast cancer incidence rates and percent urban residents as well as correlations between incidence rates of these two cancer types and population size were significantly positive. Poverty levels were inversely correlated with colorectal and lung cancer incidence rates. Our review of cancer incidence rates suggests that socio-demographic factors, such as population size (rural/urban) and poverty levels, have influenced cancer detection and incidence rates in Arizona.

KEYWORDS: Cancer Disparity, Health Disparity, American Indians, Latinos, Cancer Incidence

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INTRODUCTION

Nationally, cancer is the second leading cause of death after heart disease (Kochanek et al., 2016), but in Arizona, cancer was the leading cause of death in 2015 among Latinos and non-Hispanic Whites (NHWs). Cancer is the second leading cause of death among American Indians (AIs) and African Americans (AAs) (Bureau of Public Health Statistics). Cancer incidence and mortality varies across racial/ethnic groups and geographic regions in the U.S. (Jemal et al., 2017; Mokdad et al., 2017). Cancer incidence and mortality also varies among AIs by Indian Health Service regions and among Latino subgroups (e.g., Mexican Americans, Puerto Ricans, and Cubans) has been reported (Borrell and Crawford, 2009; Pinheiro et al., 2009; Pinheiro et al., 2011; White et al., 2011; White et al., 2014). In the Southwest region of the United States (U.S.), cancer incidence and mortality rates, especially rates for lung, prostate, breast and colorectal cancer, are lower in AIs than NHWs (White et al., 2014). Among Latinos, Mexican Americans have lower cancer incidence rates that other Latino subgroups or NHWs (Pinheiro et al., 2009), but they also have lower survival rates for common cancers than NHWs (Pinheiro et al., 2011; White et al., 2011). Furthermore, AIs and Latinos are more likely to be diagnosed with advanced stage cancer than NHWs (Clegg et al., 2002; Hoffman et al., 2014; Hoffman et al., 2001; Iqbal et al., 2015). Lower cancer survival rates may be attributed to delayed diagnosis among these medically underserved populations. However, the reasons for the variations in incidence rates are not fully understood.

Arizona is uniquely situated to investigate cancer health disparities focusing on AIs and Latinos. Arizona has the third largest population of AIs in the U.S. (Norris et al., 2012). There are 21 federally recognized AI tribes in Arizona and approximately 353,000 AIs live in Arizona (about 5.5% of total Arizona population) (Norris et al., 2012). The largest tribe is Navajo, and their reservation is located in northern Arizona, New Mexico, Utah, and Colorado. Tohono O'odham is the second largest tribe in Arizona and their reservation is east of Tucson and northern Mexico. Several Apache tribes have their reservation on the central-eastern part of Arizona. However, many AIs live in urban areas, such as Phoenix and Tucson, rather than remote rural areas. AIs living in urban areas and on reservations have varying degrees of issues related to access to health care, such as social structural, physical (transportation and physical distance), supportive, and cultural barriers (Call et al., 2006; Itty et al., 2014).

Arizona is also one of four U.S.-Mexico border states, along with California, Texas, and New Mexico. Latinos constitute the largest racial/ethnic minority group in Arizona, which accounts for approximately 30% (1.8 million) of the Arizona residents (Ennis et al., 2011). Mexican Americans are the largest Latino subgroup in Arizona (1,657,668). Many Latinos live in urban areas and southern Arizona. Over 30% of residents in southern Arizona counties along the border are Latinos, and over 50% of residents in two rural counties, Santa Cruz and Yuma, that border with Mexico are Latinos. Like AIs, Latinos face multiple barriers related to health care access, and undocumented immigrants faces even more barriers to health care, such as lack of documentations to receive health insurance (Ortega et al., 2015).

The goal of this paper was to identify areas of research necessary to reduce cancer health

disparities. In an effort to further understand cancer health disparities, cancer incidence rates among AIs and Latinos in Arizona were compared to NHWs and AAs with a focus on common types of cancer (breast, prostate, lung, and colorectal) and cancers that disproportionately affect AIs and Latinos (kidney, liver, stomach, cervical, myeloma, gallbladder, and uterine cancer). This paper focuses on AIs and Latinos, the two major racial/ethnic minority groups in Arizona. Other racial/ethnic minority groups including AAs, Asian Americans, and Native Hawaiian and other Pacific Islanders account for less than 5% of Arizona population (approximately 4.5%, 3.5%, and 0.5% respectively).

METHODS

Incidence Rates

The cancer incidence data was retrieved in November and December 2016 from the Arizona Cancer Registry (ACR) and North American Association of Central Cancer Registries (NAACCR). To compare cancer incidence rates among racial/ethnic groups and among Arizona counties, age-adjusted incidence rates (per 100,000 using the 2000 U.S. standard population) between 2004 and 2013 for each racial/ethnic group and county in Arizona were obtained from the ACR. Age-adjusted incidence rates between 1995 and 2003 were also obtained from the ACR to examine cancer incidence trends for each racial/ethnic group. The data on cancer incidence in Asian Americans and Pacific Islanders were analyzed but not used due to both the small number of cancer cases and the small statewide population size. From the NAACCR, cancer incidence rates with 95% confidence interval (CI) stratified based on age group (age <65 vs. age ≥65) and stage at diagnosis data (number of cases) between 2009 and 2013 were also obtained to reflect recent screening recommendations. Cancer incidence rates and 95% CI for each stage was retrieved from the NAACCR in March 2018.

Socio-demographic Factors

To compare the cancer incidence rate and socio-demographic factors, county-level percent urban residents, population size, poverty rates, median income, and high school graduation rates were obtained. First, percent urban population for 15 Arizona counties were obtained from 2010 Census. Second, population size based on 2010 census data was obtained from Arizona State Employment and Population Statistics. The data on poverty rates (all ages) and median income in 2014 was obtained from the U.S. Census Bureau Small Area Income and Poverty Estimates (SAIPE). The 2015 five-year high school graduation rates were also obtained from the Arizona Department of Education. Arizona Behavioral Risk Factor Surveillance System (BRFSS) data between 2010 and 2014 was reviewed and a proportion (%) and 95% CI of individuals who have barriers to health care (e.g., poverty, lack of health insurance, and not having usual source of health care) and who have had breast, colorectal, prostate, and cervical cancer screening were obtained.

Statistical Methods

Incidence rate ratios (IRRs) between AIs and NHWs and between Latinos and NHWs were calculated stratified by Medicare eligible age (<65 and ≥65) to examine if IRRs were significantly different for the younger and older age groups. IRRs were calculated by dividing the reported incidence rate in AIs or Latinos by the incidence rate in NHWs. We used 95% CI to evaluate statistical difference in incidence rates. Spearman's correlation was used to assess the correlation of cancer incidence rates with Arizona county population sizes, poverty

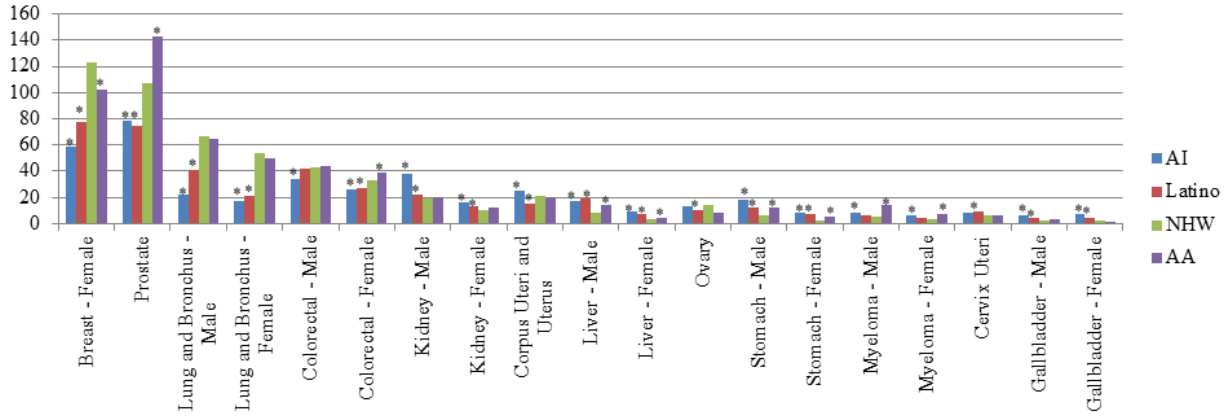
rates, median incomes, and high school graduation rates. From number of cases for each diagnostic stage obtained from NAACCR, chi-square test was used to test if diagnosis with localized or distant cancers were more frequent in AIs and Latinos. The two-tail test was used for Spearman's correlation and chi-square test.

RESULTS

Cancer Incidence Rate and Stage

We first examined differences in cancer incidence among racial/ethnic groups in the ten-year period between 2004 and 2013 (Figure 1). AIs and Latinos had significantly lower incidence rates than NHW and AAs for common screen detectable cancer (breast, prostate, and colorectal cancer) and lung cancer. In Latinos and NHWs, breast cancer incidence was higher than prostate cancer incidence. On the other hand, in AIs and AAs, prostate cancer incidence rate was higher than breast cancer incidence. Prostate cancer in AA men had the highest incidence rate. Some of less common types of cancer were more frequent in AIs, Latinos, and AAs than NHWs. AIs had a significantly higher incidence of kidney cancer, uterine cancer, liver cancer, stomach cancer, gallbladder cancer, and myeloma than NHWs. Latinos had significantly higher incidence of kidney cancer, cervical cancer, liver cancer, stomach cancer, and gallbladder cancer. AIs had a higher cervical cancer incidence rate than NHWs and AAs, but it was not statistically significant. AIs had slightly higher prostate cancer incidence rate than Latinos (statistically not significant), but breast cancer, lung cancer, and male colorectal cancer incidence rates for AIs were significantly lower than for Latinos. When stratified by gender, males had higher incidence of cancer than females. Kidney cancer incidence was very high in AI men (1.9 fold higher in AIs than in NHWs), and was the second most commonly diagnosed cancer among them.

Figure 1. Age-adjusted Cancer Incidence Rates (per 100,000) between 2004 and 2013 in Arizona * indicates statistically significant different incidence rate compared to NHW.



IRRs between AIs and NHWs and between Latinos and NHWs were examined stratified by age of diagnosis (<65 compared to ≥65) for four common cancers (breast, prostate, lung, and colorectal) and cervical cancer (Table 1). The IRRs were different between the younger age group and the older age group for prostate cancer (AI/NHW and Latino/NHW), lung cancer (Latino/NHW among men), colorectal cancer (AI/NHW among women), and cervical cancer (Latina/NHW). AIs had significantly lower prostate cancer incidence rate in the younger group, but

AIs and NHWs had similar incidence rates in the older group. The gap in the prostate cancer incidence rates between Latinos and NHWs also decreased in the older age group (IRR of 0.67 in the younger group compared to 0.91 in the order group). The difference in lung cancer incidence rate between Latino and NHW men also decreased from IRR of 0.46 in the younger group to 0.69 in the older group. On the other hand, AI women had a similar colorectal cancer incidence rate as did NHW women in the younger age group (IRR 1.05), but significantly lower incidence rate in the older age group (IRR 0.65). IRR for cervical cancer between Latina and NHW was moderately high (IRR 1.32), but even bigger incidence rate difference was observed in the older age group (IRR 2.01).

Between 1995 and 2013, overall incidence rate of all cancer types combined declined for NHW, Latino, and AA men, reflecting the decline in incidence rate of three major cancer types in men (prostate, lung and colorectal) (Figure 2, Supplementary Figure 1). The prostate and lung cancer incidence followed national trends and declined for NHW, Latino, and AA men. Colorectal cancer incidence also declined for NHW men, but not for other racial/ethnic groups.

Overall cancer incidence did not change for NHW, Latina, and AA women. Colorectal cancer incidence declined for NHW women, but it did not change for Latinas or AA women. Incidence of two other major caner types (breast and lung) did not change for NHW, Latina, and AA women. Overall cancer incidence slightly increased for AIs during this period. Colorectal cancer incidence increased for AI women. Breast cancer incidence rate did not change. Among AI men, incidence rate for prostate, colorectal, and lung cancer did not change. Over time, as the prostate and colorectal cancer incidence rates in NHW and AA men and the colorectal cancer rate in NHW women declined, the differences in prostate and colorectal cancer incidence rates among racial/ethnic groups narrowed. Incidence rates of two less common types of cancer, kidney and liver cancer, increased in all the racial/ethnic groups.

Incidence rates for each stage of diagnosis were reviewed for five cancer types, breast, prostate, lung, colorectal, and cervical cancer (Supplementary Table 1). We also examined the proportion of individuals diagnosed in each stage (Supplementary Figure 2). The incidence rates for each stage generally reflect the overall incidence rates for these cancer types exhibiting overall lower incidence rates for AIs and Latinos compared to NHW while a higher proportion of AIs and Latinos were diagnosed with advanced stage cancer, except for cervical cancer. One exception is incidence rate for distant prostate cancer. AIs and Latinos had lower overall prostate cancer incidence rate than NHWs, but they had higher incidence rate for distant (metastatic) prostate cancer than NHWs. Distant prostate cancer was more common among AIs and Latinos (17% and 8% respectively) than NHWs (5%). Incidence rate of distant breast cancer was lower in AI women compared to NHW women, but a significantly higher proportion of AI women had distant breast cancer (8% in AIs compared to 5% in NHW). Latina women had similar incidence rates for distant breast and colorectal cancer to NHW women, but a proportion of Latina women with distant breast and colorectal cancer was higher than that of NHW. Latinos and AIs have lower incidence rates of distant lung cancer. However, a higher proportion of Latino men and AI women had distant lung cancer compared to NHW men and women.

Table 1. Comparison of Cancer Incidence among AIs, Latinos, and NHWs in Two Age Groups (Age-adjusted incidence rate per 100,000 between 2009-2013 Based on 2000 US Standard Population).

		Age <65					Age ≥65				
		Incidence Rate			IRR		Incidence Rate			IRR	
Cancer Type	Gender	AI	Latino	NHW	AI/NHW	Latino/NHW	AI	Latino	NHW	AI/NHW	Latino/NHW
Breast	Female	39.3 (34.8-44.2)	57.0 (54.5-59.7)	77.4 (75.6-79.3)	0.51*	0.74*	157.2 (128.4-191.0)	292.7 (273.3-313.3)	405.4 (396.7-414.2)	0.39*	0.72*
Prostate	Male	16.4 (13.5-19.9)	25.2 (23.5-27.1)	37.5 (36.4-38.6)	0.44*	0.67*	434.0 (374.9-500.5)	375.0 (349.7-402.0)	412.2 (402.8-421.8)	1.05	0.91*
Lung and Bronchus	Male	5.2 (3.6-7.3)	8.0 (7.1-9.1)	17.3 (16.6-18.1)	0.30*	0.46*	127.0 (95.7-166.5)	257.7 (235.9-281.3)	372.2 (363.1-381.5)	0.34*	0.69*
	Female	6.8 (5.0-9.1)	6.8 (6.0-7.8)	15.1 (14.4-15.8)	0.45*	0.45*	103.9 (80.3-132.5)	159.8 (145.2-175.5)	298.7 (291.2-306.4)	0.35*	0.53*
Colorectal	Male	16.9 (13.9-20.4)	17.9 (16.4-19.4)	16.6 (15.8-17.4)	1.02	1.08	125.7 (95.5-163.9)	217.6 (197.6-239.3)	191.4 (184.8-198.1)	0.66*	1.14
	Female	13.5 (10.9-16.5)	12.7 (11.5-14.0)	12.8 (12.0-13.5)	1.05	0.99	98.5 (75.4-126.7)	141.1 (127.3-155.9)	152.6 (147.3-158.1)	0.65*	0.92
Cervix Uteri	Female	5.4 (3.9-7.5)	7.8 (6.9-8.8)	5.9 (5.3-6.4)	0.92	1.32*	12.0 (5.1-24.4)	14.9 (10.8-20.2)	7.4 (6.3-8.7)	1.62	2.01*

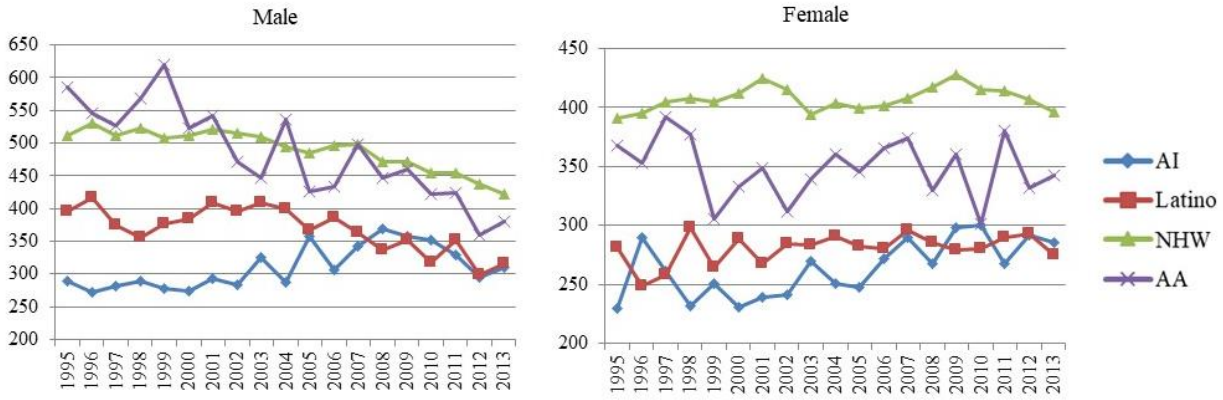
Numbers in parentheses indicate 95% confidence interval.

AI/NHW – incidence rate in AI / Incidence rate in NHW

Latino/NHW – Incidence rate in Latino / Incidence rate in NHW

* Significant difference in incidence rate based 95% confidence interval

Figure 2. Trends in Overall Cancer Incidence in Arizona between 1995 and 2013



Impacts of Socio-Demographic Factors

We compared cancer incidence rate between 2004 and 2013 with percent urban residents, population size, median income, and high school graduation rate in Arizona counties for four common cancers and cervical cancer. Counties with high percent of urban residents and large population size had significantly higher breast and prostate cancer incidence rate (Supplementary Table 2). Strong positive correlations between prostate cancer incidence rate and population size were observed (Spearman's correlation *rho*=0.775, *P*=0.001). The correlation was significant, even when NHWs and Latinos were analyzed separately. Poverty levels were inversely correlated with prostate, colorectal, and lung cancer incidence rate among men ($P<0.05$). The strongest correlation was observed for NHW men and colorectal cancer (Spearman's correlation *rho*=-0.747, *P*=0.001). Colorectal cancer incidence rates among men also increased with median income among men ($P<0.05$). Cervical cancer incidence rate was significantly inversely correlated with population size for NHW women. However, overall there were a small number of cases and three small counties had less than ten cases within each county as well as a large incidence rate with a very large 95% CI. Five-year high school graduate rates were not correlated with incidence rates of any cancer types.

Arizona BRFSS

The Arizona 2014 BRFSS results show that AIs and Latinos have more barriers to health care than NHWs. Compared to NHWs, a higher proportion of AIs and Latinos reported living below poverty line and not having health insurance (Supplementary Table 3). More Latinos also reported not being able to afford health care than NHWs (23.1% vs. 12.6%). A significantly smaller proportion of AIs and Latinos had usual source of health care (having primary care providers as a main source of health care) than NHWs and have had a preventative check-up in the past year. AAs were more likely than NHWs to report living below poverty level, but they were more likely to have a preventive check-up. While AI and Latina women had higher breast and cervical cancer screening rates than NHWs, AIs and Latinos had lower colon and prostate cancer screening rate than NHWs. It also should be noted that some risk factors of cancer are more prevalent in AIs and Latinos than NHWs. For example, obesity is more prevalent in

AIs and Latinos than NHWs (44.9% in AIs, 33.8% in Latinos, and 26.4% in NHWs). Smoking rates, on the other hand, were lower in AIs (12.0%) and Latinos (14.0%) than in NHWs (17.5%).

DISCUSSION

Cancer incidence rates were reviewed as a first step to understand cancer health disparities among AIs and Latinos in Arizona. Our review of cancer incidence rates suggests that many socio-demographic factors may have influenced the cancer detection and reported cancer incidence rates in AIs and Latinos. Cancer incidence trend as well as observed differences between incidence rate of each stage at diagnosis and a proportion of patients diagnosed in each stage are reflective of differences in cancer screening participation in AIs, Latinos, NHWs, and AAs. Decline in prostate and colorectal incidence rates in NHW and AA men generally reflect changes in screening participations. Decline in prostate cancer screening due to a recent recommendation against prostate specific antigen (PSA) screening reduced prostate cancer diagnosis, while high colon cancer screening uptake increased removal of pre-cancerous polyps reducing colorectal cancer incidence. On the other hand, continuously low screening participation in AIs may have resulted in persistently low screening detectable cancer incidence rates. Colon cancer screening rate among Latinos is also low, and colorectal incidence rate did not change over time. Although AIs and Latinos have lower cancer incidence rates, when they are diagnosed, a higher proportion of them was diagnosed with advanced stage cancer as reported in other studies (Clegg et al., 2002; Siegel et al., 2015).

Population size (urban vs. rural) and poverty levels within given counties, physician and screening facility availability, and health care coverage are interconnected factors that influence cancer screening, detection, stage at diagnosis, cancer care, and ultimately mortality (Faruque et al., 2015; Odisho et al., 2010; Stimpson et al., 2012; Tatalovich et al., 2015; Tian et al.). Issues related to health care access in AIs and Latinos in the younger age group (age <60) may have caused less frequent PSA testing and lower detection of prostate cancer among younger AI and Latino men compared to the older AI and Latino men in Medicare eligible age group (≥65). In the Arizona 2010 BRFSS, a smaller proportion of AI and Latino men reported ever having had a PSA test than NHWs men. Limited availability of urologists and primary care physicians in rural counties may also have reduced prostate cancer detections, especially in early stage. High incidence rates of distant prostate cancer in AIs and Latinos further support low screening rate influencing the prostate cancer diagnosis patterns.

The reason for lower colorectal cancer incidence in AIs in the older age compared to younger is not known, but educational level and ability to speak English may have influenced their knowledge on colon cancer screening, screening participation and detection among the older AI women (Sanderson et al., 2011). Colorectal cancer incidence and screening rates among AIs and Latinos in Arizona may also reflect issues related to health care access. Increasing colorectal cancer screening rate in NHWs reduced colorectal cancer incidence rate in NHWs. AIs and Latinos have lower colorectal cancer screening rates than NHWs, and their incidence rate did not change over time. Higher percentage of Latinas were diagnosed with distant colorectal cancer than

NHW women. Low cancer, especially colorectal cancer, incidence rates were observed in Arizona counties with high poverty rates. High poverty rates are usually found in rural counties where large AI reservations are located or a high proportion of residents are Latinos. Low density of high quality health care facilities in rural areas with high poverty rates may have reduced cancer screening and detection. However, we did not observe significant correlation between poverty levels and colorectal cancer incidence rate in Latinos.

Women's health programs that provided service to low-income uninsured and underinsured women have been successful (Lantz and Mullen, 2015), and AI and Latino women in Arizona have similar or higher breast and cervical cancer screening rate when compared with NHWs women. However, higher proportion of AIs and Latinas were diagnosed with distant breast cancer than NHWs. AI and Latina women living rural areas of Arizona are less likely to receive breast and cervical cancer screening than in AI and Latina women living urban areas (Nuño et al., 2012). It is likely that AIs and Latinas tended to be diagnosed with more advance stage cancer due to lower screening rates in these rural areas with high poverty levels.

Cancer incidence rate in AIs and Latinos are generally lower than NHWs, but incidence rate of less common types of cancer was higher in AIs and Latinos. Kidney and liver cancer incidence rates were particularly high in AIs and Latinos compared to NHWs and increasing. Kidney and liver cancer as well as other less common types of cancer, such as stomach and uterine cancer, that are disproportionately affecting AIs and Latinos, are linked to obesity (Lauby-Secretan et al., 2016), and obesity is more prevalent in AIs and Latinos in Arizona. Although there is an effort to provide service to medically underserved women (Lantz and Mullen, 2015), AI and Latino men may have heavier burden of cancer than AI and Latina women. Cancer incidence rates in men are generally higher than women. In the general population, lung and breast cancer have a higher mortality rate than other types of cancers, but in Arizona AIs, prostate cancer mortality rate is higher than the mortality rate for other types of cancers (Arizona Cancer Registry, 2013). Despite the high cancer burden, AI and Latino men have low health care utilization (Livingstone et al., 2008; Rhoades, 2003).

One of limitations of this study is that this was an ecological study and cancer incidence trends and correlations with socio-demographic factors were investigated, and this study did not investigate how individual level socio-demographic, behavioral factors, and cultural values affected cancer screening behavior and detection. The independent effects of these correlated factors will be explored in our future studies.

After reviewing cancer incidence rates among AIs and Latinos in Arizona, we identified several issues that need to be addressed through research. First, it is necessary to develop programs to increase cancer screening among AIs and Latinos. AIs and Latinos are less likely to participate in colon and prostate cancer screening, and they are more likely to be diagnosed with advanced cancer. Because of potential harms including high rate of false positive, overdiagnosis and overtreatment, and treatment complication, AI and Latino men should be encouraged to discuss the benefit and risk of prostate cancer screening with their health care provider (U. S. Preventive Services Task Force, 2018). Second, it is necessary to find effective ways

to reduce barriers to health care, especially in rural areas. AIs and Latinos have more barriers to health care and are less likely to receive medical care. Racial/ethnic minority individuals living in rural areas may have additional barriers to health care. Third, some of risk factors for cancer, such as obesity and diabetes, are more prevalent in AIs and Latinos and need to be reduced. Culturally tailored intervention and education programs need to be developed to increase cancer screening and reduce cancer risk factors. Fourth, AI and Latino men are less likely to receive health care. Programs targeting to AI and Latino men, especially low-income uninsured and underinsured men, need to be developed to improve their health care utilization and cancer screening.

CONCLUSION

Differences in incidence rates among racial/ethnic groups reflect differences in socio-demographic factors (poverty, population density, and age), health care access, screening participation, and/or lifestyle. AIs and Latinos in Arizona have multiple barriers to health care and barriers to health care influence their cancer screening participation, detection, care, and ultimately mortality.

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ONLINE SOURCE

Arizona Cancer Registry Database Query System
http://healthdata.az.gov/query/module_selection/azcr/AzCRSelection.html

North American Association of Central Cancer Registries Fast Stats
https://faststats.naaccr.org/

Conflict of interest

The authors declare that no competing or conflict of interests exists. The funders had no role in study design, writing of the manuscript, or decision to publish.

Authors' contributions

KB, FCG, ALE, and RAK conceptualized the study. KB performed analysis. All the authors contributed to interpretation of analysis results, writing, and editing.

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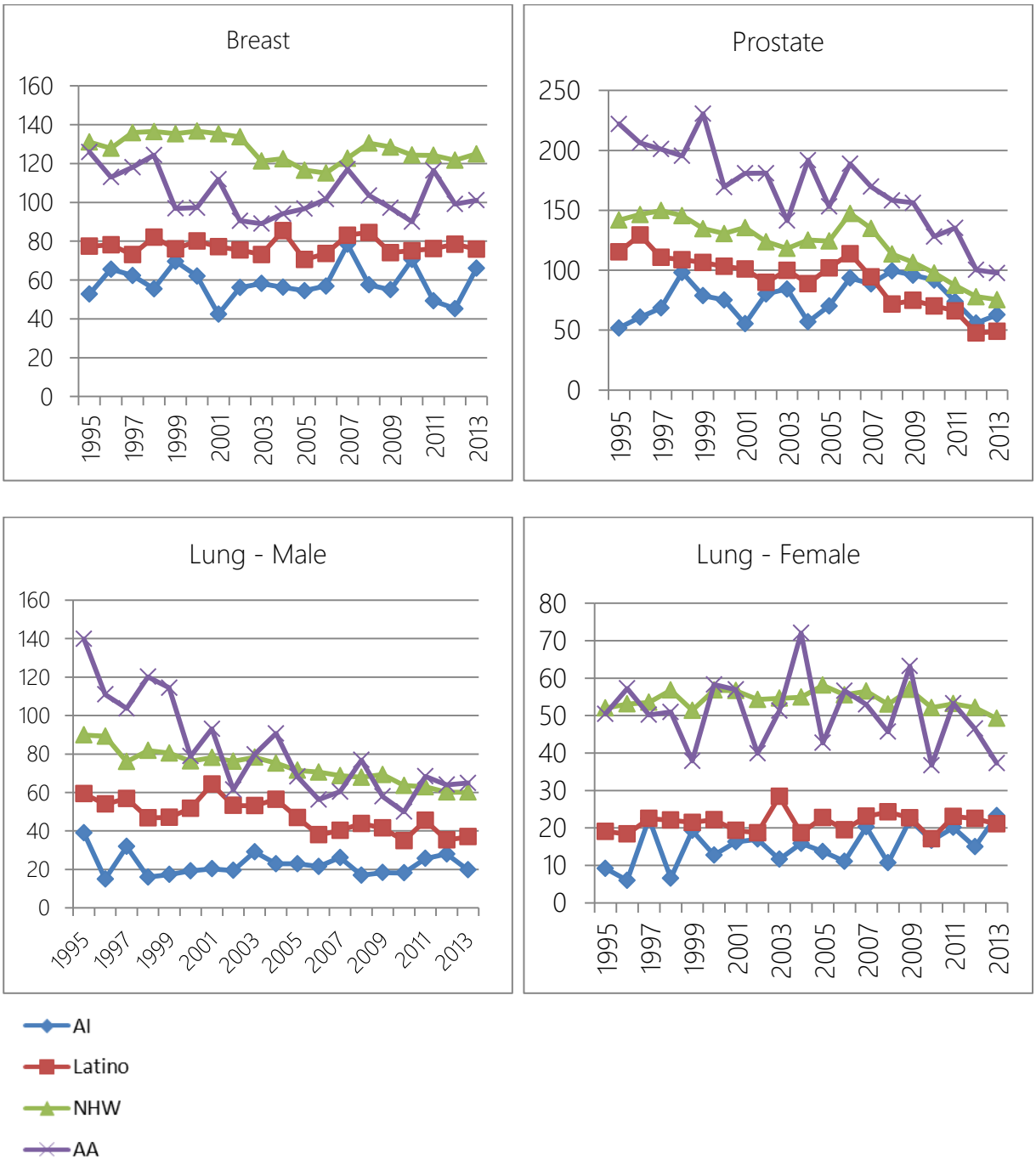
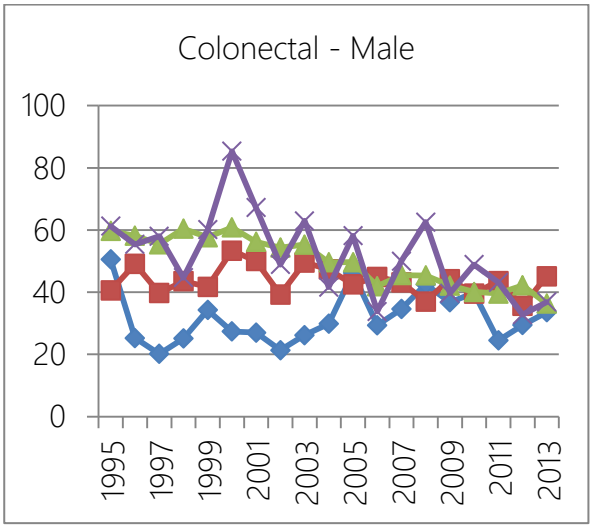
Supplementary Materials

Supplementary Figure 1. Trends in Cancer Incidence in Arizona between 1995 and 2013 (Age-adjusted incidence rate per 100,000)




Colonectal - Male
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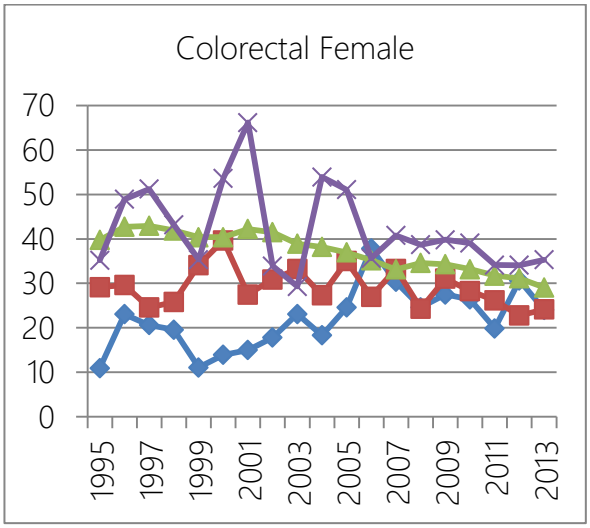
Colorectal Female
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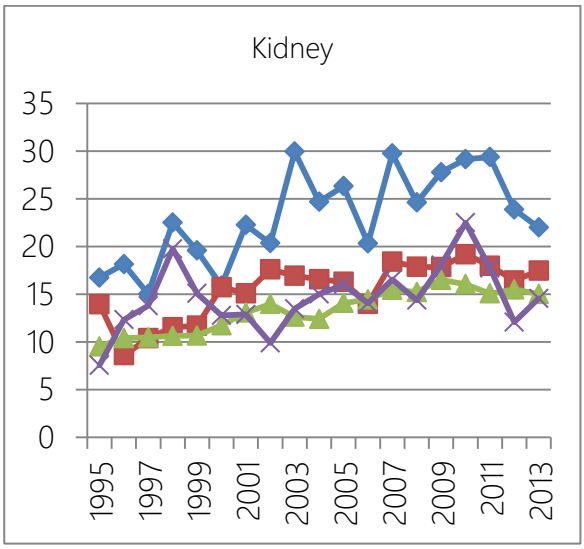
Kidney
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25
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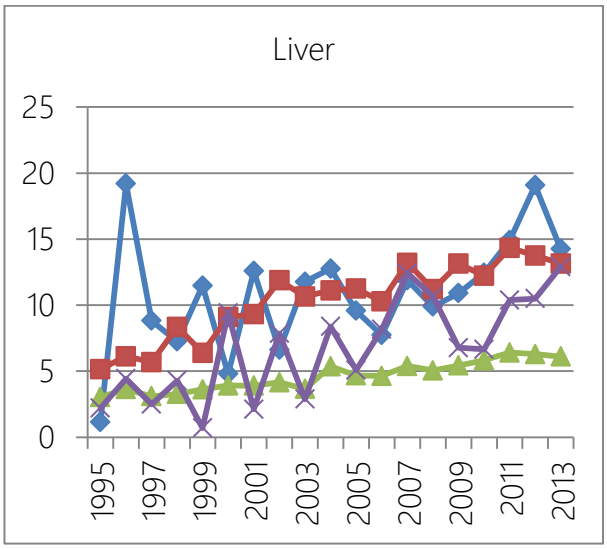
Liver
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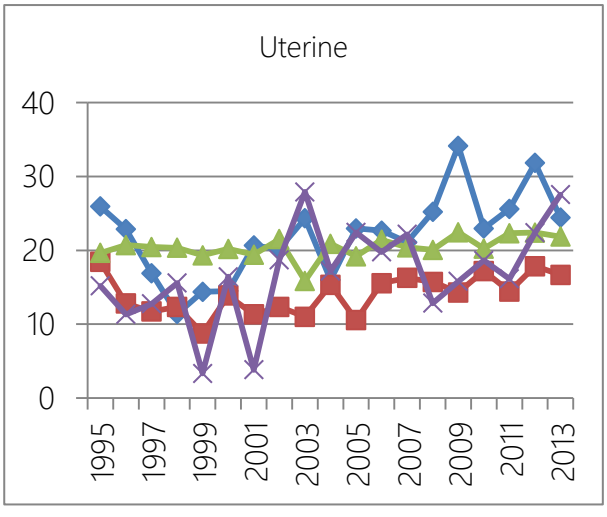
AI
Latino
NHW
AA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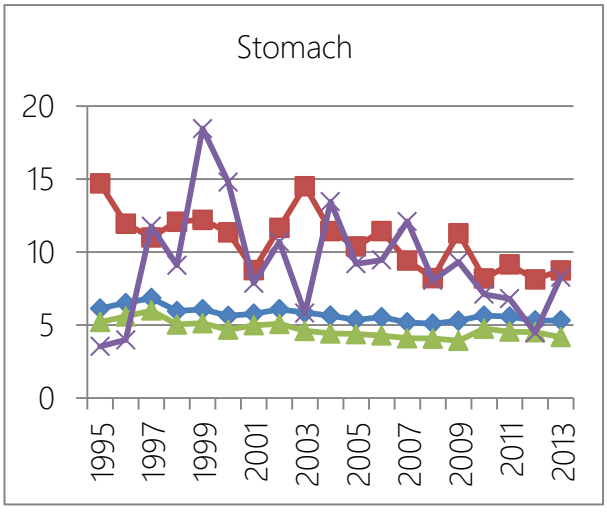
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1995
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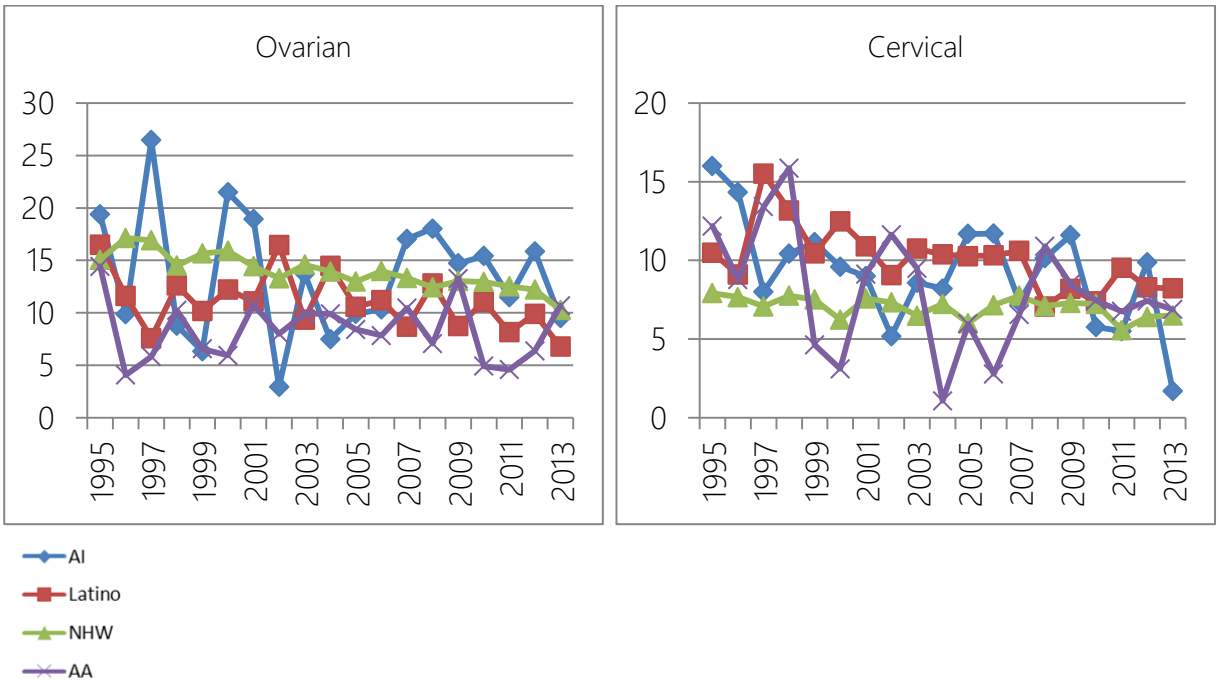
2013


Ovarian
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2013
Cervical
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1999
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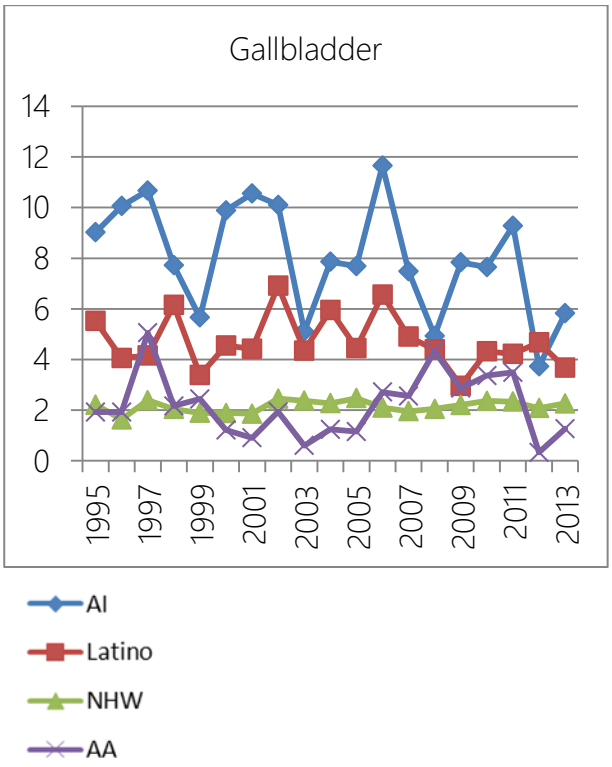
2003
2005
2007
2009
2011
2013
AI
Latino
NHW
AA


Gallbladder
14
12
10
8
6
4
2
0
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1997
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AI
Latino
NHW
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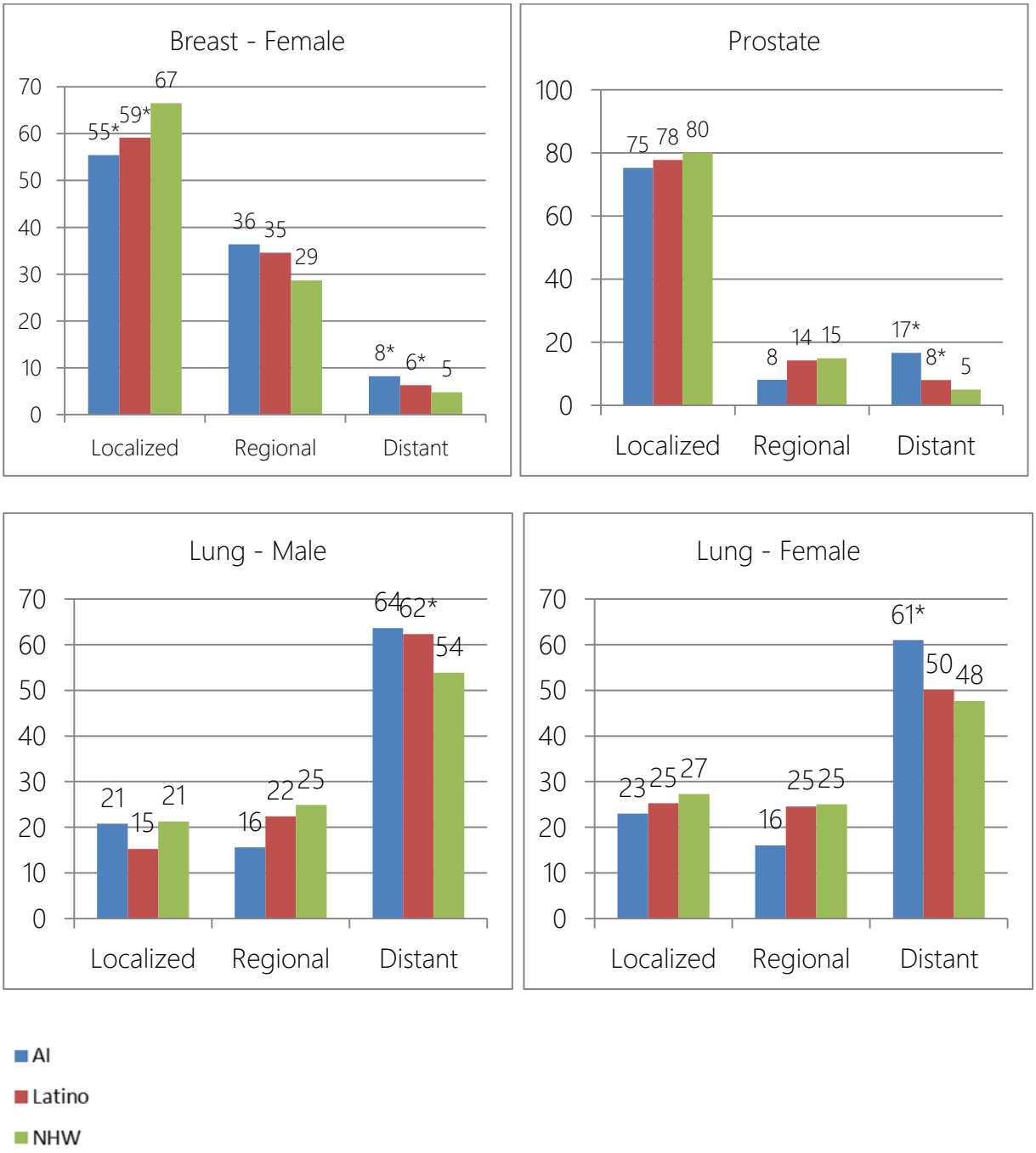
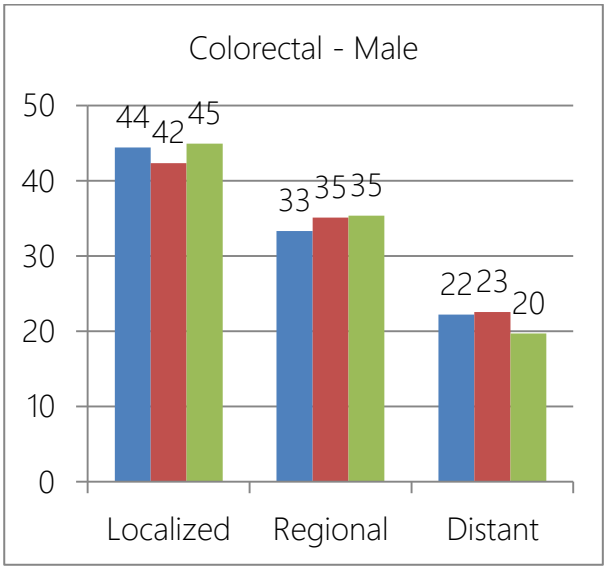
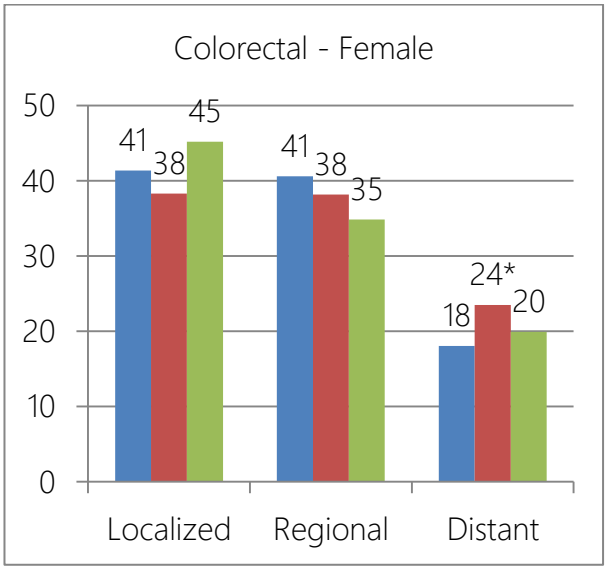
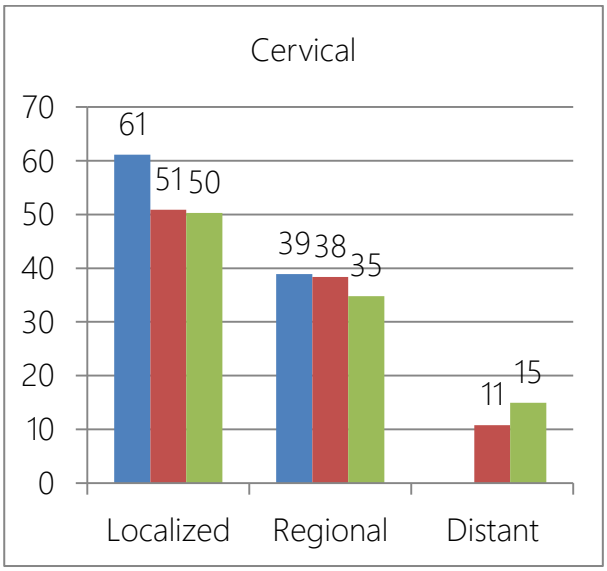
Supplementary Figure 2. Comparison of Stage at Diagnosis between 2009 and 2013 (Percentage). * indicates statistically significant difference compared to NHW with $P<0.05$.









AI
Latino
NHW

*Supplementary Table 1. Comparison of Stage at Diagnosis between 2010 and 2014: Incidence rate (IR) and 95% CI. * indicates significantly higher incidence rate compared to NHW*

			Localized		Regional		Distant	
			IR	95% CI	IR	95% CI	IR	95% CI
Breast	Female	NHW	73.8	72.3-75.3	33.3	32.2-34.4	5.6	5.2-6.0
		Latina	50.4	47.9-53.0	26.4	24.7-28.3	4.9	4.2-5.8
		AI	29.7	25.8-34.2	18.8	15.8-22.4	3.2	2.0-4.9

Prostate	Male	NHW	54.8	53.5-56.0	10.6	10.0-11.1	4.2	3.8-4.52
		Latino	39.7	37.2-42.4	7.8	6.8-9.0	5.5	4.51-6.7
		AI	34.7	29.5-40.7	3.5	2.1-5.8	11.3*	8.1-15.5
Lung	Male	NHW	10.4	9.9-11.0	12.1	11.5-12.7	25.8	25.0-26.7
		Latino	4.7	3.8-5.9	6.6	5.4-7.9	18.5	16.6-20.6
		AI	4.2	2.4-6.9	3.2	1.7-5.8	10.9	8.0-14.8
	Female	NHW	11.2	10.6-11.7	10.2	9.7-10.7	20.0	19.3-20.8
		Latina	5.4	4.6-6.4	5.3	4.4-6.3	10.7	9.6-12.1
		AI	2.9	1.7-4.7	3.2	1.9-5.0	10.0	7.6-12.9
Colorectal	Male	NHW	14.6	14.0-15.3	12.1	11.5-12.7	6.9	6.5-7.4
		Latino	14.9	13.3-16.6	14.1	12.5-15.8	8.1	7.0-9.4
		AI	11.1	8.4-14.7	9.9	7.4-13.2	6.1	4.1-8.9
	Female	NHW	11.8	11.2-12.4	9.4	8.8-9.8	5.5	5.1-5.9
		Latina	9.4	8.3-10.6	10.2	9.0-11.5	5.4	4.6-6.4
		AI	7.6	5.6-10.0	9.1	6.8-11.8	3.1	1.9-4.9
Cervical	Female	NHW	2.9	2.5-3.3	1.6	1.3-1.9	0.7	0.5-0.9
		Latina	3.4	2.8-4.0	2.7	2.2-3.3	1.0	0.7-1.4
		AI	2.2	1.3-3.6	1.9	1.0-3.3		

Supplementary Table 2. Correlation between Cancer Incidence Rate and Socio-demographic Factors.

			Percent Urban Population	Population Size in 2010	Poverty Level	Median Income	High School Graduation Rate				Percent Urban Population	Population Size in 2010
	Gender		*rho*	*P*	*rho*	*P*	*Rho*	*P*	*rho*	*P*	*rho*	*P*
Prostate	Male	All	0.475	0.07	**0.775**	**0.001**	-0.375	0.17	-0.004	0.99	-0.175	0.53
		NHW	**0.627**	**0.01**	**0.670**	**0.006**	**-0.524**	**0.045**	0.265	0.34	0.057	0.84
		Latino	**0.604**	**0.02**	**0.593**	**0.02**	-0.479	0.07	0.361	0.19	0.243	0.38
Breast	Female	All	**0.639**	**0.01**	**0.689**	**0.004**	**-0.533**	**0.04**	0.314	0.25	-0.150	0.59
		NHW	**0.689**	**0.004**	0.471	0.08	-0.223	0.42	0.132	0.64	0.311	0.26
		Latino	0.518	0.048	0.425	0.11	-0.177	0.53	0.396	0.14	-0.161	0.57
Lung	Both	All	0.004	0.99	-0.007	0.98	**-0.572**	**0.03**	0.264	0.34	-0.246	0.38
		NHW	0.011	0.97	-0.157	0.58	-0.306	0.27	0.143	0.61	0.004	0.99
		Latino	-0.089	0.75	-0.229	0.41	-0.048	0.86	0.236	0.40	0.132	0.64
	Male	All	-0.018	0.95	0.089	0.75	**-0.552**	**0.03**	0.229	0.41	-0.129	0.65
		NHW	0.111	0.69	0.061	0.83	-0.259	0.35	0.057	0.84	0.093	0.74
		Latino	0.032	0.91	-0.334	0.22	-0.268	0.33	0.329	0.23	0.011	0.97
	Female	All	0.282	0.31	0.375	0.17	-0.272	0.33	0.004	0.99	-0.336	0.22
		NHW	0.104	0.71	0.000	1.00	-0.429	0.11	0.193	0.49	-0.157	0.58
		Latina	-0.020	0.95	-0.029	0.92	0.378	0.18	-0.156	0.59	0.209	0.47
Colorectal	Both	All	0.257	0.36	0.071	0.80	**-0.697**	**0.004**	0.343	0.21	-0.039	0.89
		NHW	0.236	0.40	0.039	0.89	**-0.602**	**0.02**	0.314	0.25	-0.043	0.88
		Latino	-0.068	0.81	-0.171	0.54	-0.088	0.76	0.143	0.61	-0.193	0.49

	Male	All	0.354	0.20	0.218	0.44	**-0.731**	**0.002**	**0.518**	**0.048**	-0.032	0.91
		NHW	0.336	0.22	0.271	0.33	**-0.747**	**0.001**	**0.525**	**0.04**	-0.125	0.66
		Latino	-0.229	0.41	-0.096	0.73	0.011	0.97	0.057	0.84	0.093	0.74
	Female	All	0.225	0.42	0.064	0.82	-0.379	0.16	0.057	0.84	-0.254	0.36
		NHW	0.182	0.52	0.057	0.84	-0.172	0.54	-0.043	0.88	-0.229	0.41
		Latina	0.021	0.94	-0.221	0.43	-0.200	0.47	0.282	0.31	-0.107	0.70
Cervix	Female	All	-0.239	0.39	-0.282	0.31	-0.082	0.77	-0.004	0.99	-0.139	0.62
		NHW	**-0.615**	**0.03**	**-0.769**	**0.002**	0.272	0.37	0.154	0.62	0.038	0.90
		Latina	-0.216	0.46	0.051	0.86	-0.123	0.67	-0.286	0.32	-0.095	0.75

Statistically significant correlations are shown with bold.

Supplementary Table 3. Barriers to Health Care, Cancer Screening Rate, and Cancer Risk Factors (Arizona Behavioral Risk Factor Surveillance System data)

	AI		Latino/Latina		AA		NHW	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Barriers to Health Care								
Living below 133% federal poverty line	11.1	6.4-15.8	13.8	12.0-15.6	9.9	6.0-13.7	2.8	2.3-3.2
Not having health insurance coverage	16.0	10.4-21.6	27.6	24.4-30.8	14.7	9.1-20.4	8.9	7.7-10.0
Could not afford health care	14.0	8.9-19.1	23.1	20.1-26.1	16.1	10.7-21.5	12.6	11.5-13.7
Usual source of health care	54.1	46.8-61.5	58.9	55.4-62.3	75.7	68.7-82.6	79.7	77.7-80.4
Preventive Care Utilization								
Had preventive check up in the last year	64.0	56.5-71.4	58.0	54.6-61.5	76.9	70.1-83.7	66.1	64.7-67.6
Cancer Screening								

Ever had a Fecal Occult Blood Test	27.5	17.4-37.6	21.4	17.4-25.4	41.4	33.0-49.7	40.1	38.7-41.5
Ever had a Colonoscopy or sigmoidoscopy	34.6	24.9-44.3	54.6	49.4-59.8	70.6	62.3-78.9	71.5	70.1-72.9
Had a mammogram in the past year	62.4	49.9-75.0	57.6	52.1-63.2	62.1	51.6-72.6	55.9	54.0-57.9
Had a Pap Smear within the last 3 years	84.5	77.5-91.5	81.7	77.9-85.6	83.9	77.2-90.7	69.5	67.9-71.1
Ever had a PSA testa	19.2		53.8		77.2		80.5	
Cancer Risk Factors								
Current smoker	12.0	7.8-16.2	14.0	11.5-16.5	16.2	10.9-21.6	17.5	16.3-18.8
Obesity (BMI>30)	44.9	37.4-52.5	33.8	30.5-37.1	36.8	29.6-44.0	26.4	25.1-27.7
Diabetes	14.8	10.2-19.3	10.4	7.7-13.8	10.7	7.7-13.8	9.9	9.2-10.6
High Blood Pressure	30.4	20.5-40.4	22.0	17.9-26.0	40.1	29.5-50.8	33.1	31.2-34.9

2014 Arizona Behavioral Risk Factor Surveillance System Report (http://azdhs.gov/preparedness/public-health-statistics/behavioral-risk-factor-surveillance/index.php#reports) [a] Prostate Specific Antigen (PSA) screening test data is from 2010 Arizona Behavioral Risk Factor Surveillance System Report, and 95% CI was not reported.