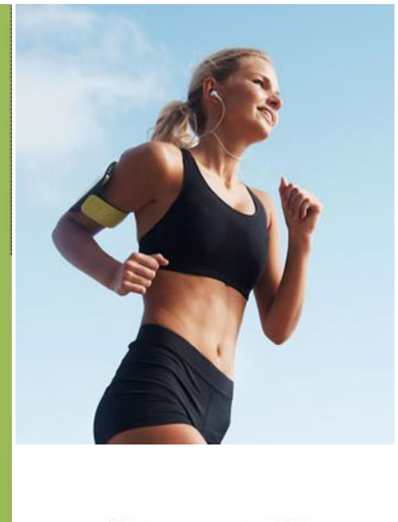
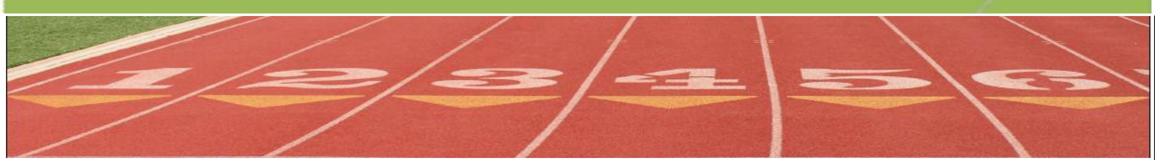
Weight-Related Cancers in Florida 1992-2013





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Contents

Executive Summary

This monograph evaluates Florida cancer incidence trends for known and suspected weight-related cancers given the growing epidemic in obesity rates across the country and evaluates the risk factors from which further research can be performed. The results represent an initial assessment of Florida's standing among national trends and is the first of subsequent monographs dedicated towards tracking weight-related cancers by sex and race/ethnicity. While these cancer trends are reported by statistical significance, comparisons to trends on weight and national cancer trends were calculated based on self-reported data. The monograph includes the major findings from analysis of age-adjusted incidence rate (per 100,000) trends between 1992 and 2013, and are presented in the form of the average percent change (APC) and p-value statistics.

Among the weight-related cancers, the most significant decreases were observed for colorectal cancers (CRC), most notably among non-Hispanic White men at a rate of 74 in 1992 to 41 in 2013. Likewise, rates among non-Hispanic Black men decreased from a peak rate of 72 in 1996 to a rate of 50 in 2013. Women were similarly affected; non-Hispanic Whites demonstrated a decrease from 52 to 31 during this time period, and significant decreases were also observed among the other female groups. Colon cancer trends resulted in changes similar to those from the CRC analysis.

The most significant increases in weight-related cancer incidence trends were observed for thyroid cancers, exceeding the increases in other cancers, the greatest of which was among female thyroid cancers. For example, non-Hispanic White females had an increase in the rate from 6.4 in 1992 to 19.3 in 2013. Significant increases were also observed among female non-Hispanic Blacks (3.9 to 14.5), Hispanics (7.5 to 20.3) and non-Hispanic others (5.1 to 19.3). Thyroid cancers increased among males, although not as dramatically, and were greatest among individuals identified as non-Hispanic other (3.9 to 6.1).

There was a significant increase in male kidney cancer, and differences were larger for non-Hispanic Black and White male Floridians relative to increases nationally. Between 1992 and 2013 non-Hispanic Black men went from a rate of 13.2 to 18.6. Increases were observed among Non-Hispanic White women (7.8 to 11.1 in 2008), but declined after 2008.

Among males, there were significant and large increases for liver cancer for all groups with the exception of Hispanics who had a smaller but significant increase. The increase among non-Hispanic Whites increased from 4.19 to 10.5, non-Hispanic Blacks increased from 8.4 to 10.48 and non-Hispanic other increased from 7.3 to 10.0. Among females, a significant increase was observed only for non-Hispanic Whites (1.5 to 3.0).

For post-menopausal and cervical cancers among women there were both increases and decreases. Post-menopausal breast cancers among non-Hispanic Blacks and non-Hispanic others increased significantly (239.8 to 279.6, and 95.8 to 245.6, respectively), while there was a large significant decrease among non-Hispanic White women between 2001 and 2005 (377.8 to 316.8). Cervical cancer incidence rates reversed their early improvement among non-Hispanic Whites showing recent small significant increases in rates from 27.9 in 2004 to 31.7 in 2013.

The findings presented in the report provide an initial examination of weight-related cancers in Florida with these main goals: to serve public health interests in reducing and preventing cancer morbidity and mortality, to provide the public health community with relevant information, and to support further implementation of targeted cancer services in Florida.

A. Introduction and Background

Obesity is associated with increased mortality.[1-3] Obesity is associated with a cascade of effects which can lead to inflammation, metabolic syndrome, diabetes, and hypertension--risks which can lead to cardiovascular disease.[4] More recently, there has been an increased focus on studies that show the association between excess weight and obesity with an increased risk of selected cancers.[5]

Worldwide, it is estimated that 3.6% of all new cancers are attributable to overweight and obesity (defined as a body mass index [BMI] of 25 kg/m^2 or greater).[6] Furthermore, an estimated 12.8% of the following cancers were attributable to overweight and obesity: esophageal adenocarcinoma and colon, rectal, kidney, pancreatic, gallbladder, breast (postmenopausal), corpus uteri, and ovarian cancers.

More than one-third of adults in the United States, and 17% of its youth, are obese.[7] In 2014, each state had an adult obesity prevalence of at least 20%.[8] One in four adults in Florida is obese, defined by a body mass index (BMI) of 30 or higher. Both nationwide and in Florida, the four most common cancer sites are breast, prostate, lung, and colorectal cancers.[9] In a major review of published studies in 2002, the International Agency for Research on Cancer (IACR) linked excess weight and obesity to two of these top cancers, showing obesity as a cause of 11% of colon cancers and 9% of postmenopausal breast cancers.[10] The study also linked obesity with multiple other types of cancer. These findings were affirmed in the National Cancer Institute's Annual Plan and Budget Proposal for Fiscal Year 2016.[11] The plan stresses the importance of understanding associations between obesity and specific cancers.

The 2011 Annual Report to the Nation on the Status of Cancer 1975-2008, focused on cancers associated with excess weight and lack of physical activity.[12] Included in this report was a review of more than 7,000 studies on the relation of nutrition, weight, and cancer. The review showed increase risk between excess weight and many cancers, including esophageal, colorectal, kidney, pancreas, endometrial cancer, and post-menopausal female breast cancer. To determine how Florida compares with national trends, this monograph will examine the relationship between excess weight and obesity and select cancers in Florida. A review of data from 1992- 2013 will compare findings in Florida with those described in the 2011 Annual Report to the Nation.

B. Methods

The data in this report were derived from all cancer cases residing in Florida, diagnosed between 1992 and 2013, and reported to the Florida Cancer Data System (FCDS). The FCDS is a statewide, population-based cancer incidence registry created by the State of Florida Department of Health in 1978, and operated by the Sylvester Comprehensive Cancer Center at the University of Miami Leonard M. Miller School of Medicine with support from the Florida Department of Health and from the Centers for Disease Control and Prevention (CDC and the National Program for Cancer

Registries (NPCR).

In October 1994, the Florida Cancer Data System became part of the National Program of Cancer Registries (NPCR) administered by the Centers for Disease Control (CDC). Through this program the CDC provides funding for states, such as Florida, to enhance their existing registry to meet national standards for completeness, timeliness and data quality set forth by the North American Association of Central Registries (NAACCR), the American College of Surgeons, Commission on Cancer (ACoS/CoC) and the Surveillance, Epidemiology and End Results (SEER) reporting program of the National Cancer Institute (NCI). Florida has one of the highest crude incidence rate of cancer in the nation with a 17,500,000 population residing in 67 counties.

Two hundred thirty hospitals report over 200,000 cases annually, which when unduplicated, translate into approximately 115,000 newly diagnosed cases per year. At this time, the FCDS database contains over 3,400,000 cancer incidence records. FCDS also maintains a cancer mortality file based on data provided from the State of Florida Bureau of Vital Statistics. The mortality data are linked with the incidence data and provide hospital-based cancer programs, researchers and other professionals access to "passive" follow up data.

Survey and Weight Data

The Florida Behavioral Risk Factor Surveillance System (BRFSS) is a state-based telephone surveillance system designed to collect data on individual risk behaviors and preventive health practices related to the leading causes of morbidity and mortality in the United States. The target population of the Florida BRFSS are people 18 years and older who reside in a Florida household. The BRFSS utilizes a disproportionate stratified sample (DSS) design for landline telephone samples and random sample for the cellular telephone survey. The data used to generate the percentage of overweight or obese adults in Florida by county was obtained from the 2013 Florida BRFSS.

B.1. Selection of Weight-Related Cancers

Analysis was conducted in this report on all weight–associated cancers that were the focus of the 2011 Annual Report to the Nation on the Status of Cancer.[12] An analysis was also performed to assess liver, thyroid, and gallbladder cancer trends given emerging evidence that these cancers are also associated with obesity.[10,13-15] All cancer sites in the analysis represent invasive cancers among Florida residents at the time of diagnosis, for all ages, with the exception of breast cancer cases for which only females age 50 and older were included. Primary cancer site and histology data were coded according to the International Classification of Diseases for Oncology edition in use at the time of diagnosis, converted to the third edition,[16] and categorized according to Surveillance, Epidemiology and End Results (SEER)site groups.[17] Cancers examined include esophageal and stomach combined (C15.0-C15.9; C16.0-C16.9), colon (C18.0-C18.9, C26.0), colorectal (C18.0-C18.9, C26.0, C19.9, C20.9), kidney and renal pelvis (C64.9, C65.9), pancreas (C25.0- C25.9), post-menopausal female breast cancer (C50.0-C50.9), cervix uteri and corpus uteri (C53.0-C53.9,C54.0-C54.9), liver (C22.0), thyroid gland and other endocrine including thymus (C37.9, C74.0-74.9, C75.0- C75.9), and gallbladder cancers (C23.9).

B.2. Body Mass Index (BMI) Categories for Weight-Related Cancers

The FCDS collects height and weight information on all reported cases since 2011. Both height and weight data were used to calculate BMI categories for adult cancers (age > 17). Cases were removed where height was below 50 inches. The BMI was calculated based on the following formula: weight (lb)/[height (in)]^2. For adults, the BMI is interpreted using standard weight status categories as identified by the CDC.[20]

B.3. Cancer Rates

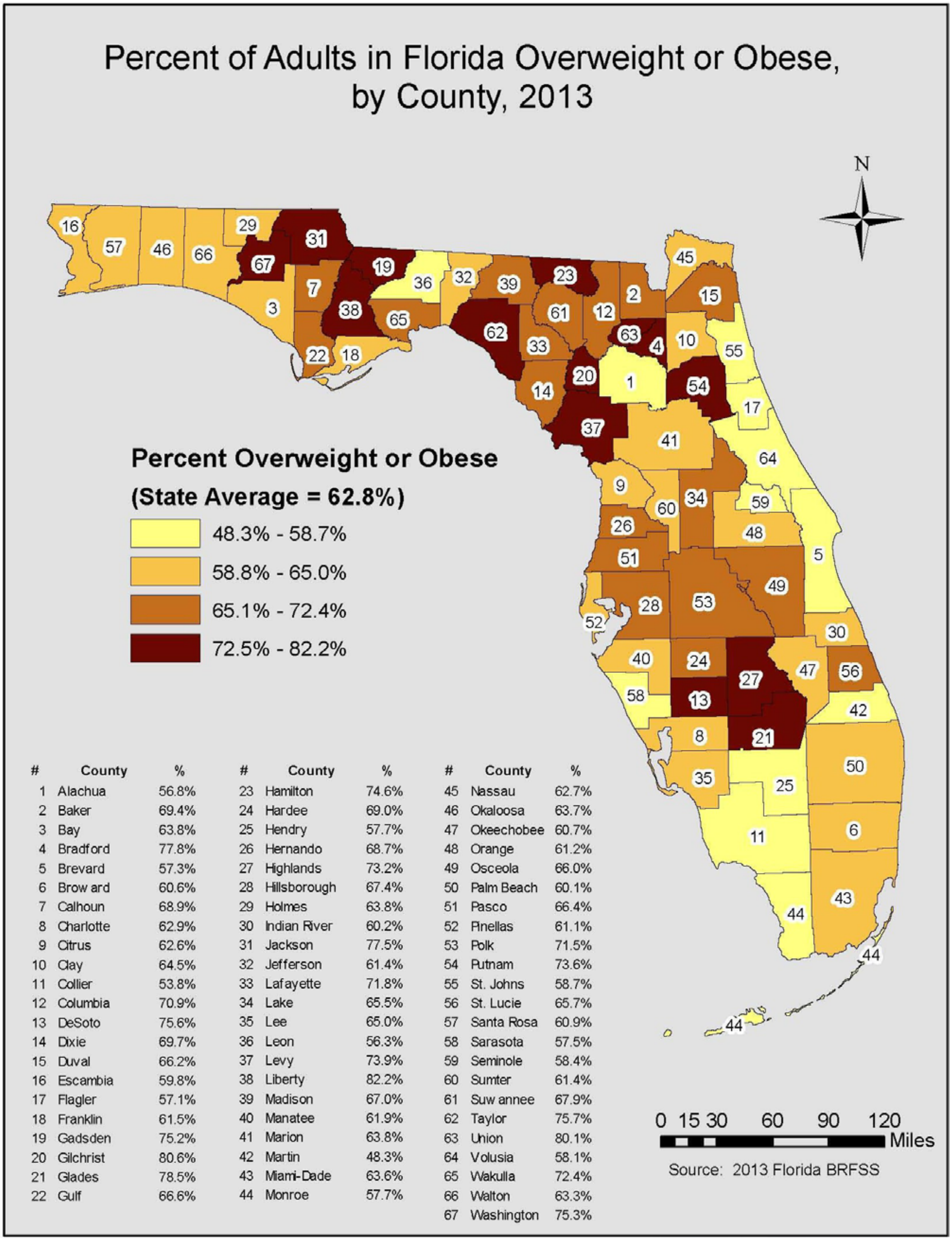
Age and gender-specific population data for the state of Florida for each race/ethnic group for the study years were obtained from the U.S. Census Bureau for the underlying denominator of all persons at risk. As noted above, for the incidence analysis, all records of invasive Hispanic cancers diagnosed among Florida residents of all races and ethnicities during the 18-year period were used in the analysis.

Cancer incidence rates are expressed as per 100,000 population and age-adjusted by 18 age groups (0–4, 5–9, . . ., 80–84, 85 and above) to the 2000 U.S. standard population. Age-adjustment is a process to correct for the differences in cancer cases and death counts caused by differing age composition among different populations and counties. Standard errors and 95% confidence intervals (95% CI) were generated using equations published by SEER*Stat.[18] The values were produced to enable long-term cancer incidence trends to be reviewed by conducting a Joinpoint analysis for all select cancer cases.[19] To protect confidentiality, data were suppressed when cell counts were less than 10 cancer cases (FCDS/DOH data suppression policy for publication).

B.4. Joinpoint Analyses

The analyses of cancer incidence trends between 1992 and 2013 were conducted using the Joinpoint regression log linear model, where statistically significant rate changes (increase or decrease) determine the best fitting points, or “joinpoints.” The analysis begins with a minimum number of joinpoints (e.g. zero or a straight line), and tests whether one or more points are significant and whether they should be added to the model by means of the Monte Carlo Permutation method.[19] The final model represents a statistically significant change in a trend at each joinpoint. The Annual Percent Change (APC), or the average rate of change in a cancer rate, was generated for each joinpoint segment and was tested at the $\rho < 0.05$ to determine if the rate of change was significantly different from zero. The Joinpoint analyses were performed using the Joinpoint software, version 3.3, from the Surveillance Research Program of the U.S. National Cancer Institute (available at http://srab.cancer.gov/joinpoint).

C. Florida Weight Figures by County



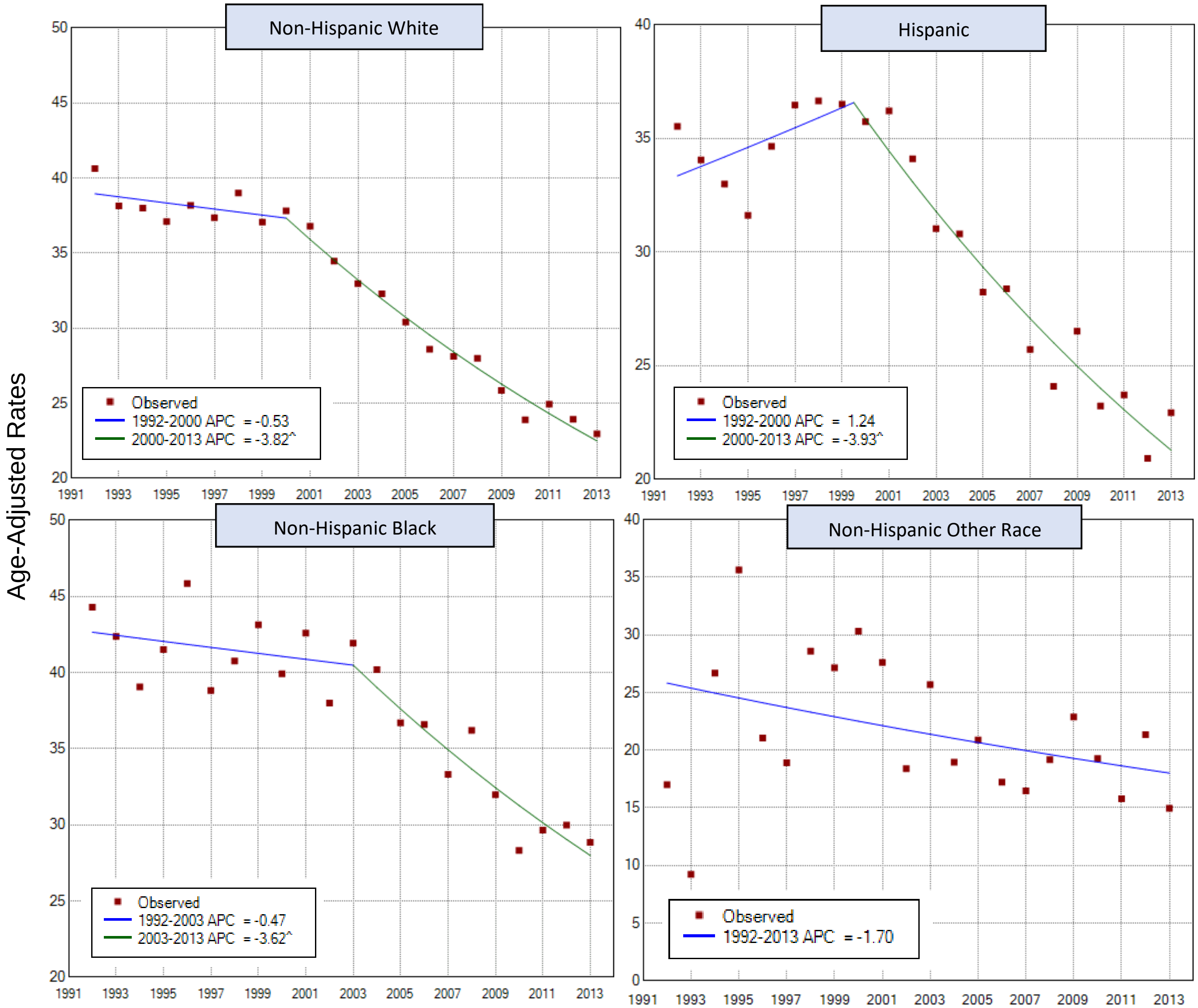
#	County	%	#	County	%	#	County	%
1	Alachua	56.8%	23	Hamilton	74.6%	45	Nassau	62.7%
2	Baker	69.4%	24	Hardee	69.0%	46	Okaloosa	63.7%
3	Bay	63.8%	25	Hendry	57.7%	47	Okeechobee	60.7%
4	Bradford	77.8%	26	Hernando	68.7%	48	Orange	61.2%
5	Brevard	57.3%	27	Highlands	73.2%	49	Osceola	66.0%
6	Brow ard	60.6%	28	Hillsborough	67.4%	50	Palm Beach	60.1%
7	Calhoun	68.9%	29	Holmes	63.8%	51	Pasco	66.4%
8	Charlotte	62.9%	30	Indian River	60.2%	52	Pinellas	61.1%
9	Citrus	62.6%	31	Jackson	77.5%	53	Polk	71.5%
10	Clay	64.5%	32	Jefferson	61.4%	54	Putnam	73.6%
11	Collier	53.8%	33	Lafayette	71.8%	55	St. Johns	58.7%
12	Columbia	70.9%	34	Lake	65.5%	56	St. Lucie	65.7%
13	DeSoto	75.6%	35	Lee	65.0%	57	Santa Rosa	60.9%
14	Dixie	69.7%	36	Leon	56.3%	58	Sarasota	57.5%
15	Duval	66.2%	37	Levy	73.9%	59	Seminole	58.4%
16	Escambia	59.8%	38	Liberty	82.2%	60	Sumter	61.4%
17	Flagler	57.1%	39	Madison	67.0%	61	Suw annee	67.9%
18	Franklin	61.5%	40	Manatee	61.9%	62	Taylor	75.7%
19	Gadsden	75.2%	41	Marion	63.8%	63	Union	80.1%
20	Gilchrist	80.6%	42	Martin	48.3%	64	Volusia	58.1%
21	Glades	78.5%	43	Miami-Dade	63.6%	65	Wakulla	72.4%
22	Gulf	66.6%	44	Monroe	57.7%	66	Walton	63.3%
						67	Washington	75.3%

The percent of adults in Florida who were overweight or obese in 2013 are presented by county in section C. The overall state average in 2013 was 62.8%. Higher percentages of obesity and overweight persons were observed in the panhandle and northern regions of the state in counties such as Jackson (77%), Liberty (82%) and Putnam (73%) Counties. Higher rates were also present in central regions such as Desoto (75%), Highlands (73%) and Glades (78%) Counties. Lower rates were observed along the northeastern coast of Florida from St. Johns County (58%) to Brevard County (57%). Additionally, counties in the southwest region of the state demonstrated lower percentages, such as Collier (53%), Monroe (57%) and Hendry (57%) Counties.

D. Results

D.1. Female Colon Cancer Trends

Figure 1. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Colon Cancer by Race/Ethnicity

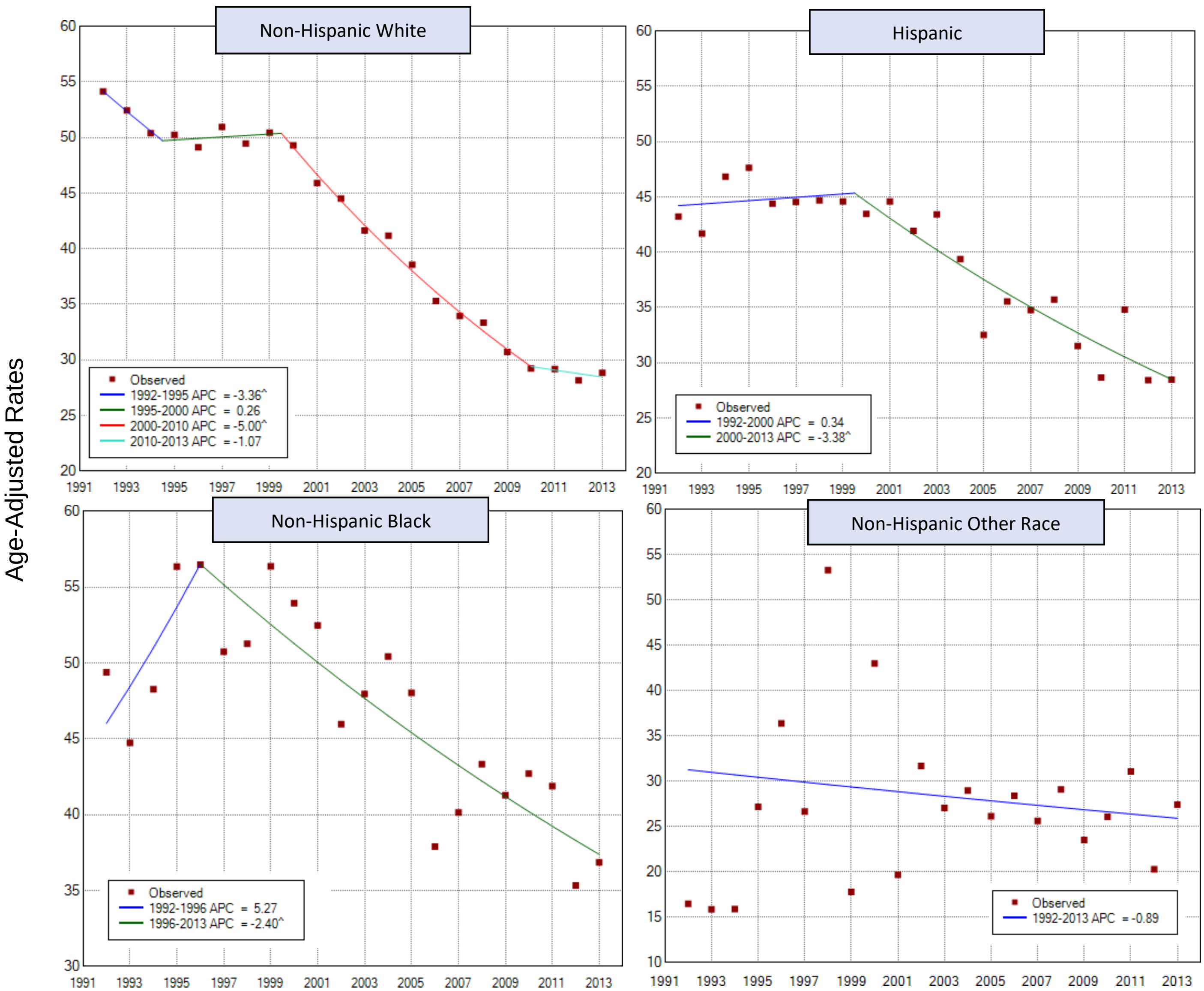


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

Among females, colon cancer decreased significantly for non-Hispanic White, non-Hispanic Black, and Hispanic groups, with an average percent decrease of 3.82, 3.62, and 3.93 respectively beginning in the early 2000s. There was no significant change among the non-Hispanic other race category. This decreasing trend is in line with the national trends for women by race and ethnicity.[12]

D.2. Male Colon Cancer Trends

Figure 2. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Male Colon Cancer by Race/Ethnicity

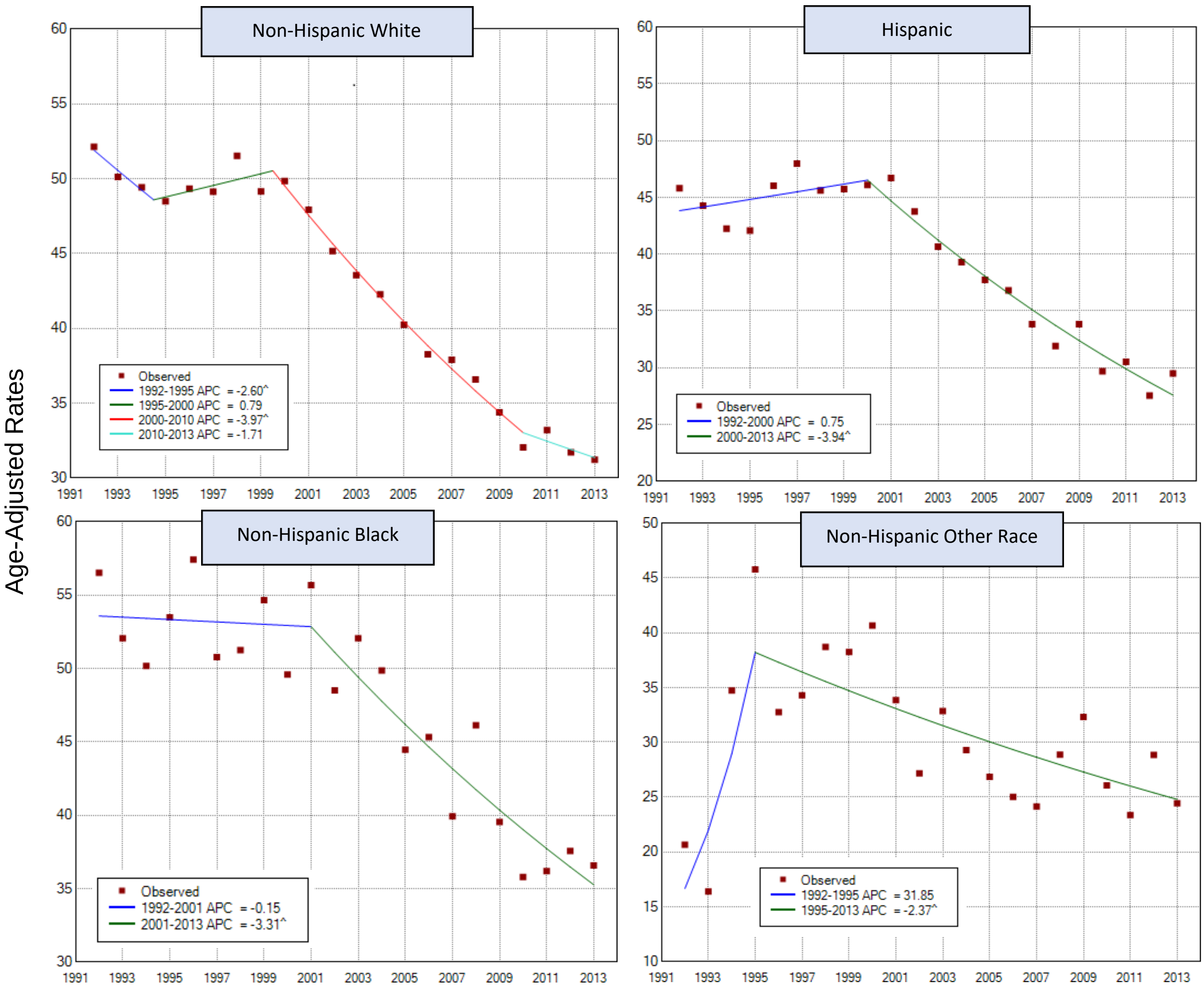


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; *Pp*< .05).

Among males, colon cancer reduced significantly for non-Hispanic Whites, non-Hispanic Blacks and Hispanics, with non-Hispanic Whites experiencing the greatest decrease between 2000 and 2010 (-5.00 APC). There was no significant decrease among non-Hispanic men of other races. This decreasing trend is in line with the national trends for men by race and ethnicity.[12]

D.3. Female Colorectal Cancer Trends

Figure 3. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Colorectal Cancer by Race/Ethnicity

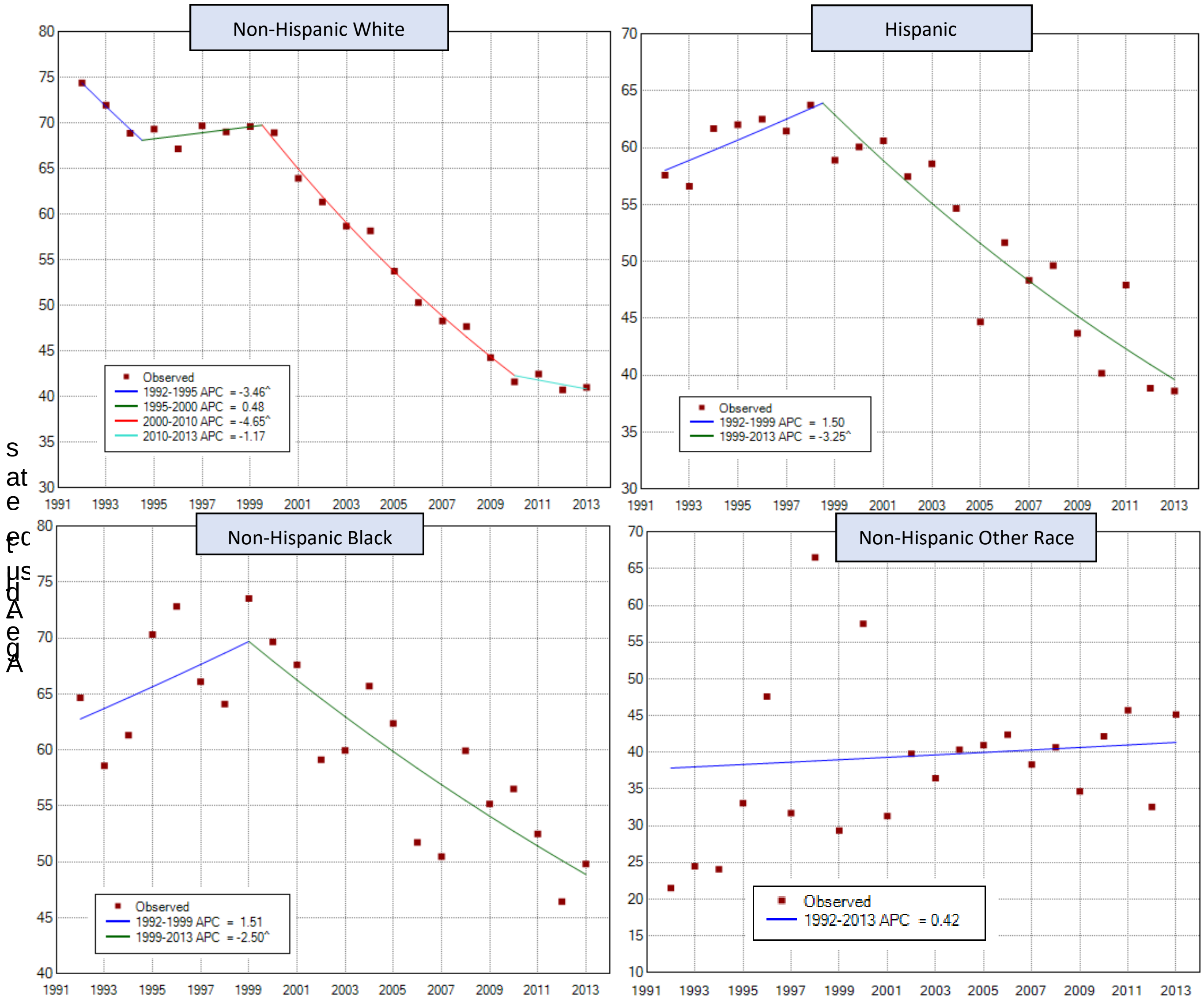


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t* test; $P < .05$).

Among females, colorectal cancer reduced significantly for all race/ethnic groups in this analysis. Among non-Hispanic Whites, a significant reduction was observed between 1992 and 1995 (APC -2.60) and 2000 and 2010 (APC -3.97). Hispanic and non-Hispanic Black women also had significant reductions beginning from 2000 with an APC of -3.94 and -3.31, respectively. A similar but longer temporal decreasing trend was observed for non-Hispanic other women at an APC of -2.37. This decreasing trend is in line with the national trends for women by race and ethnicity.[12]

D.4. Male Colorectal Cancer Trends

Figure 4. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Male Colorectal Cancer by Race/Ethnicity

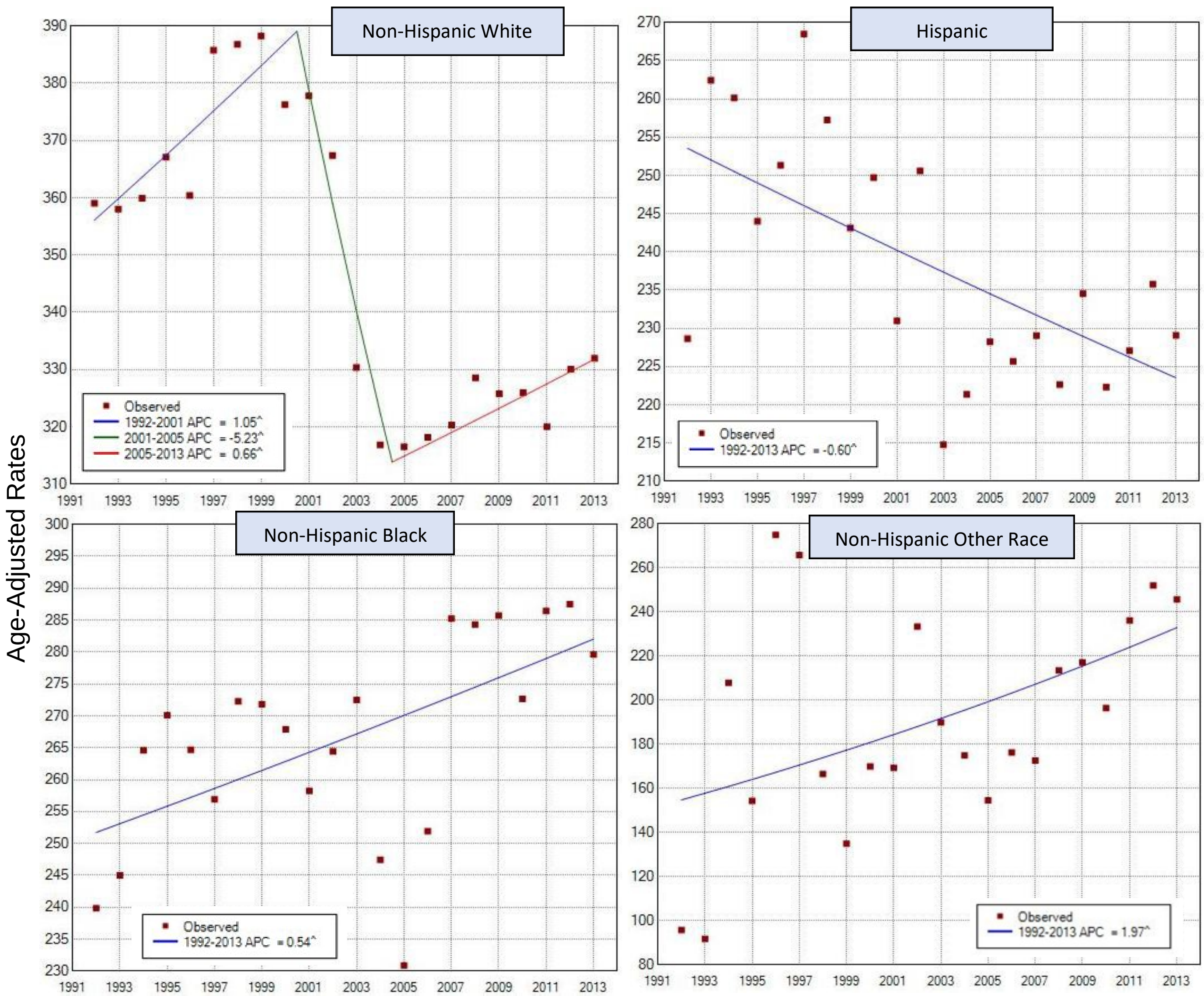


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

Among males, colorectal cancer reduced significantly for non-Hispanic Whites, non-Hispanic Blacks and Hispanics, with non-Hispanic Whites experiencing the sharpest decrease between 2000 and 2010 (-4.65 APC). There was no significant decrease among non-Hispanic men of other races, which may be due to low counts. Similar trends were observed among colon cancer in men. This decreasing trend is in line with the national trends for men by race and ethnicity.[12]

D.5. Female Breast Cancer Trends (age>=50)

Figure 5. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female, Age 50 and greater, Breast Cancer by Race/Ethnicity

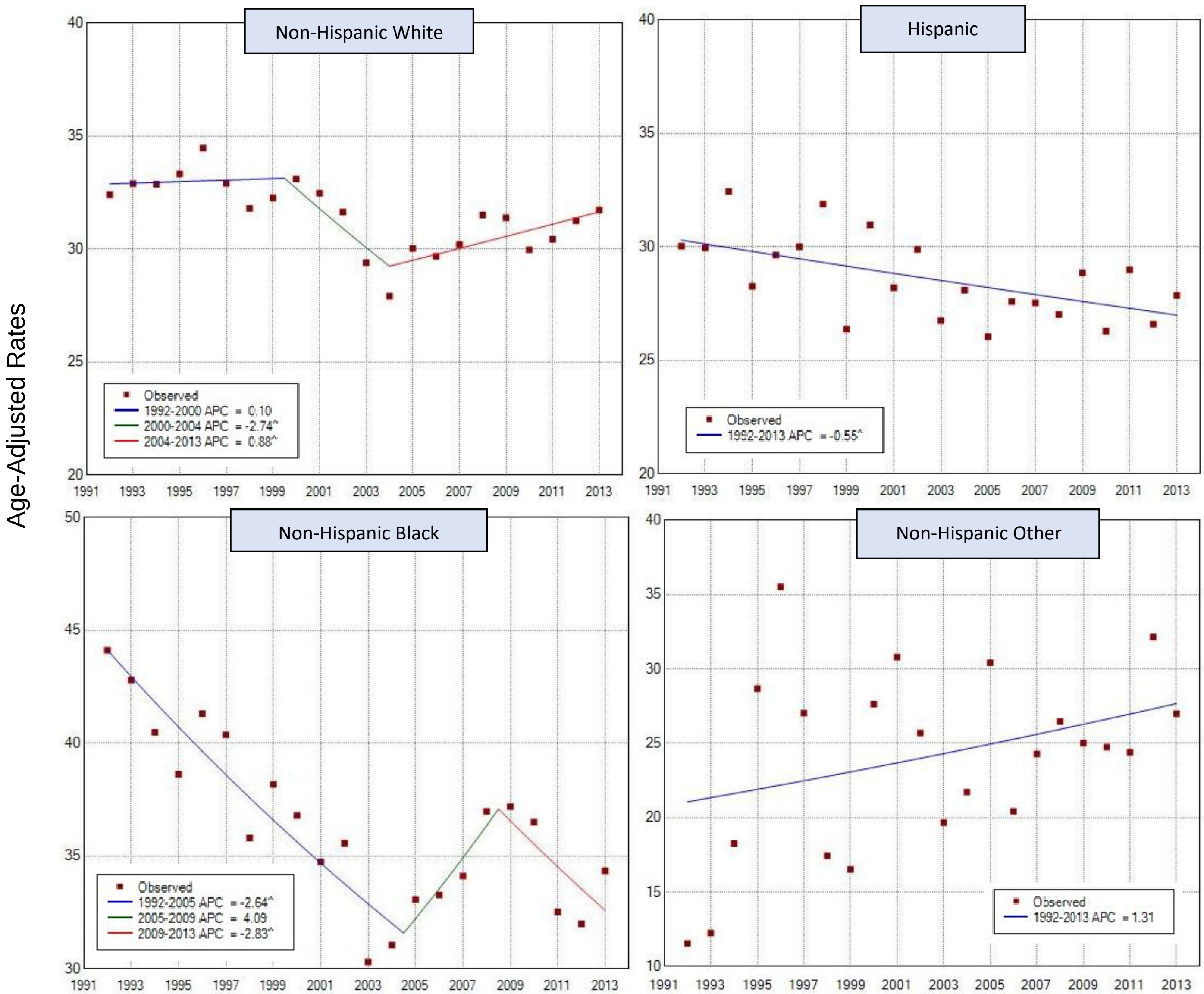


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; *p* < .05).

There are variations in the observed female breast cancer trends among women in the post-menopausal stage of life. Statistically significant decreases occurred in non-Hispanic Whites between 2000 and 2004 (-5.23 APC). A smaller yet significant decrease occurred among Hispanics (-0.60), and a statistically significant increase occurred among non-Hispanic Blacks and other non-Hispanic racial groups (0.54, 1.97 respectively), albeit slight. Nationally, incidence rates have decreased among women of all ages and race/ethnic groups combined since 1990; however, significant decreases were only observed among non-Hispanic White and non-Hispanic groups.[12]

D.6. Cervical Cancer Trends

Figure 6. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Cervical Cancer by Race/Ethnicity

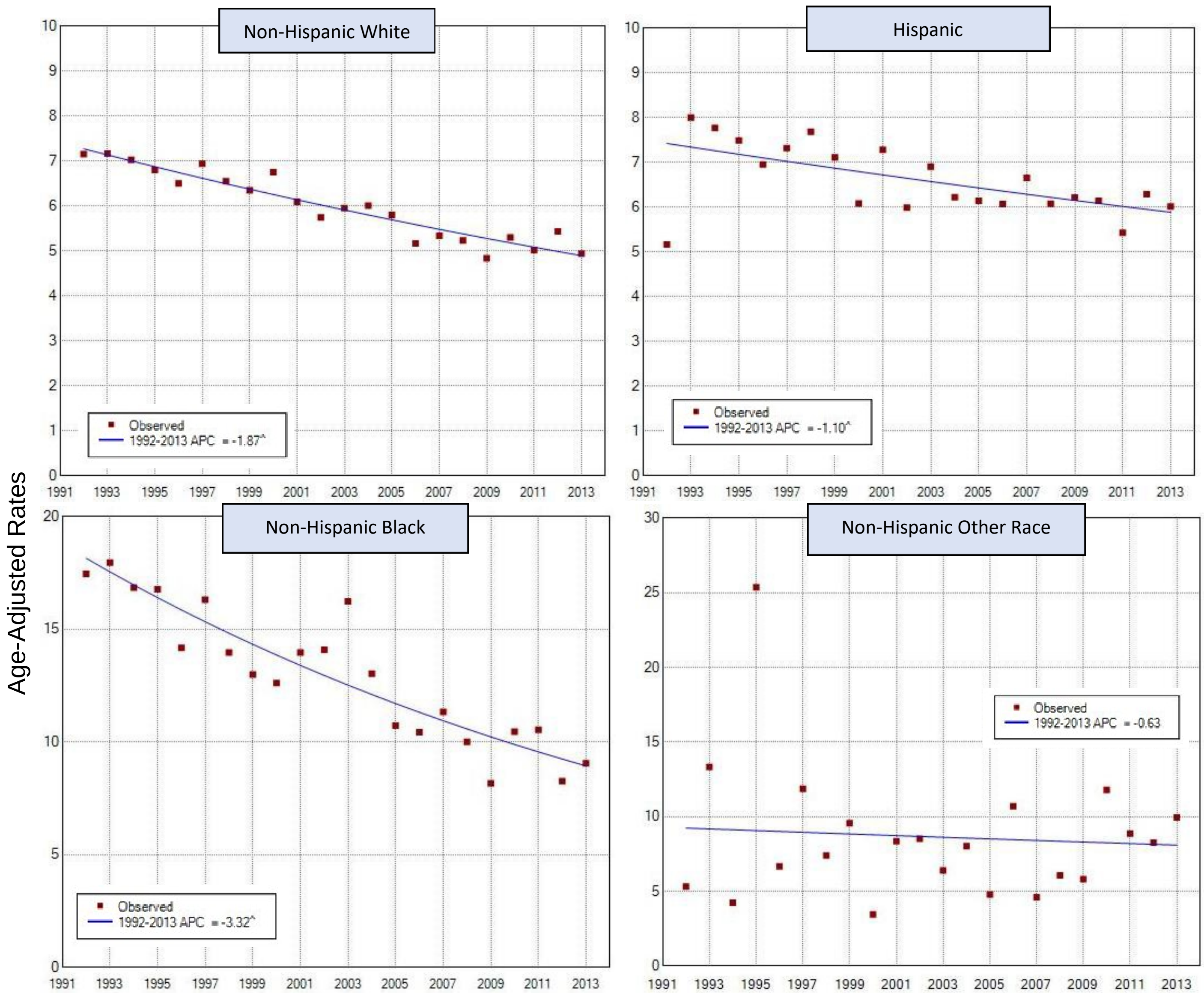


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

There are variations in the observed cervical cancer trends among women since 1992. Rates among non-Hispanic White and non-Hispanic Black women decreased significantly until 2005, increased for a period of years for non- Hispanic Whites, and continued to decline for non-Hispanic Blacks. Incident rates among Hispanic women declined significantly from 1992 to 2013 (-0.55). There were no observed changes in rates among the non-Hispanic other race category. Nationally, decreasing trends were observed among women of different race/ethnic categories for cancers of the cervix.[12]

D.7. Female Esophageal and Stomach Cancer Combined Trends

Figure 7. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Esophagus/Stomach Cancer by Race/Ethnicity

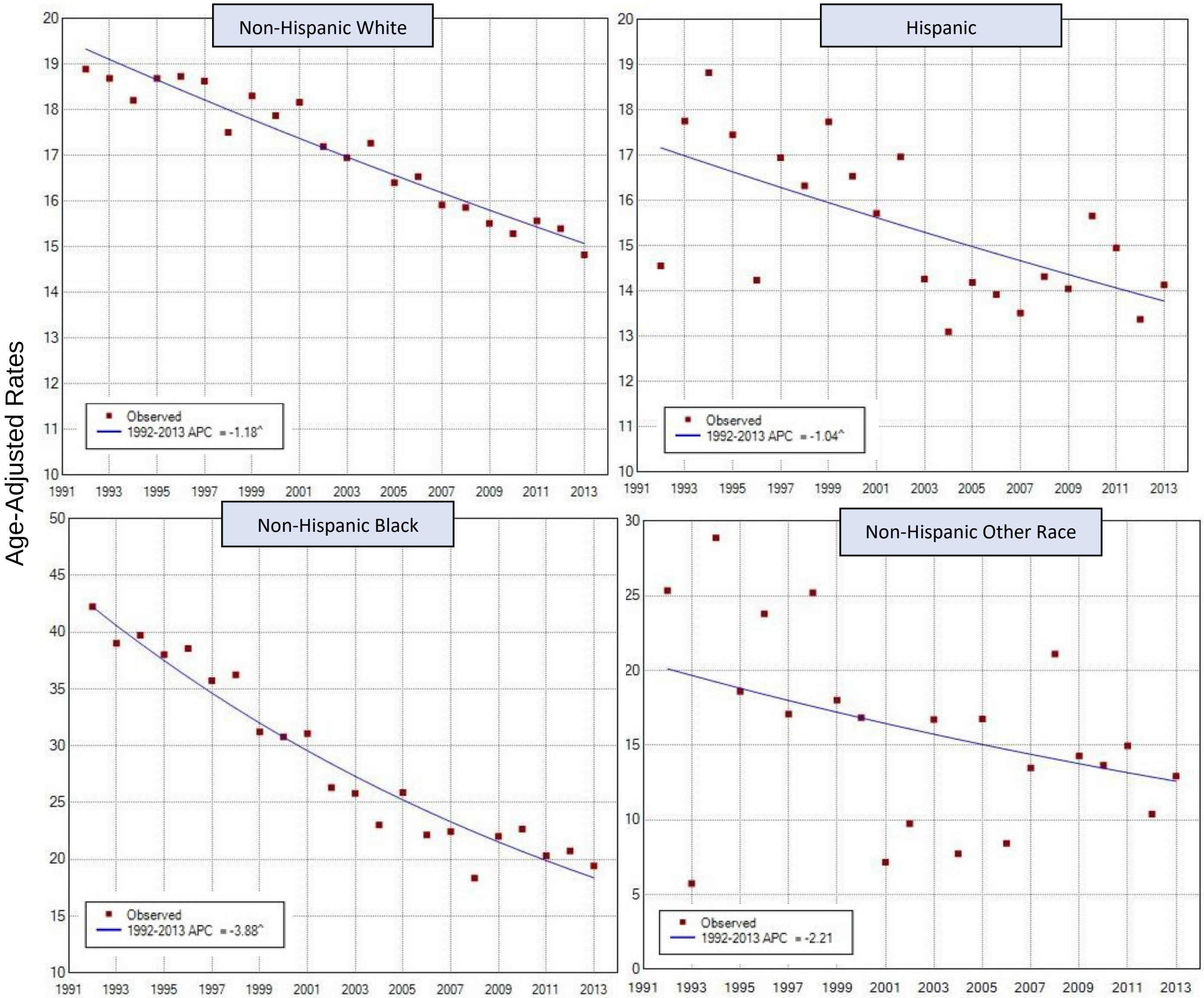


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

Since 1992, statistically significant declines in esophageal and stomach cancer rates occurred among women of all race/ethnic groups except for the non-Hispanic other race/ethnic groups. Declining trends were greatest for non-Hispanic Black women (-3.32 APC). Decreasing trends were also observed nationally for stomach and esophageal cancers among women.[12]

D.8. Male Esophageal and Stomach Cancer Combined Trends

Figure 8. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Male Esophagus/Stomach Cancer by Race/Ethnicity

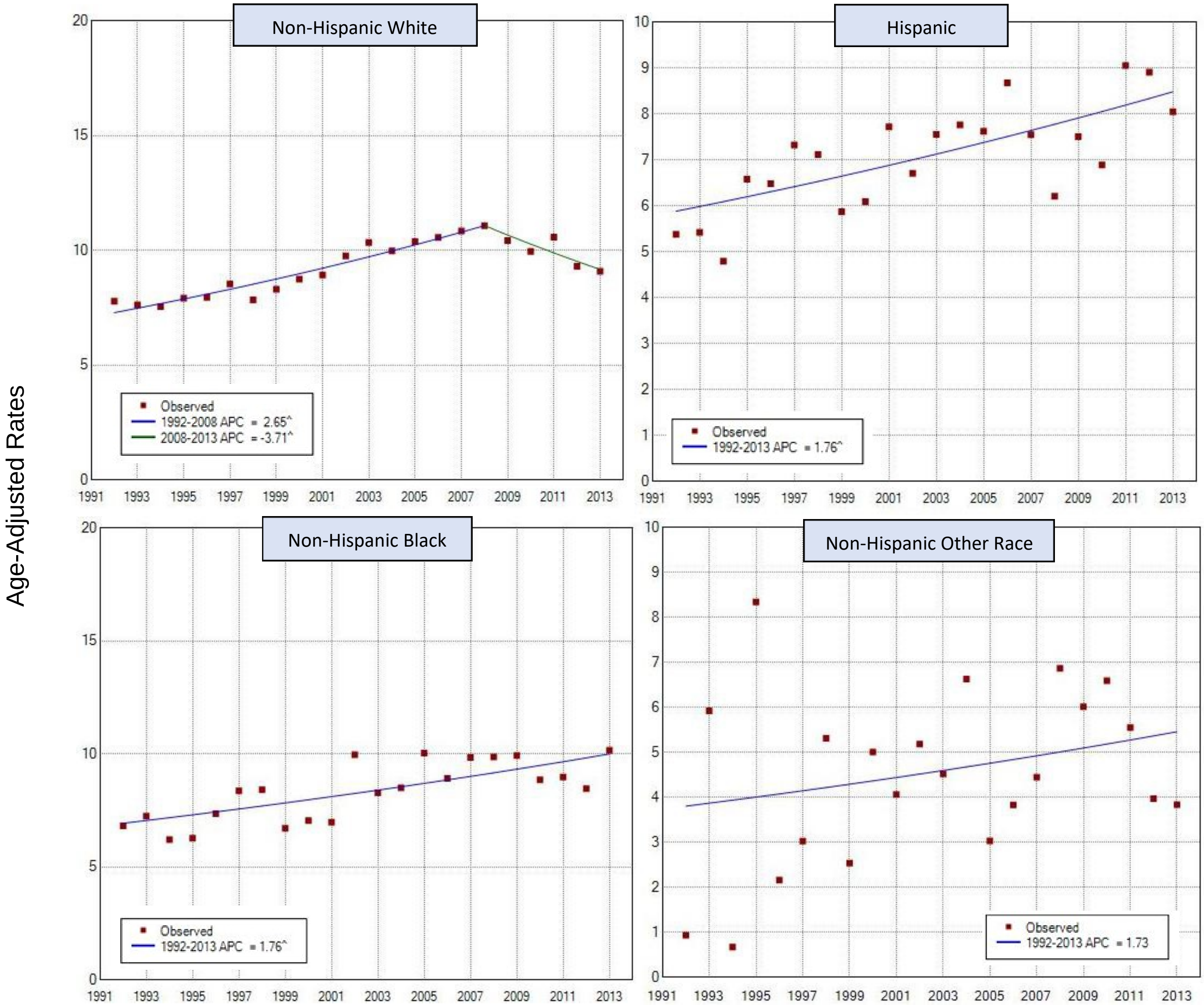


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

Since 1992, statistically significant declines in esophageal and stomach cancer rates occurred among men of all race/ethnic groups except for the non-Hispanic other race category. Declining trends were greatest for non-Hispanic Black men (-3.88). Similar trends were seen among women by race/ethnic groups. Decreasing trends were also observed nationally for stomach and esophageal cancers.[12]

D.9. Female Kidney Cancer Trends

Figure 9. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Kidney Cancer by Race/Ethnicity



Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
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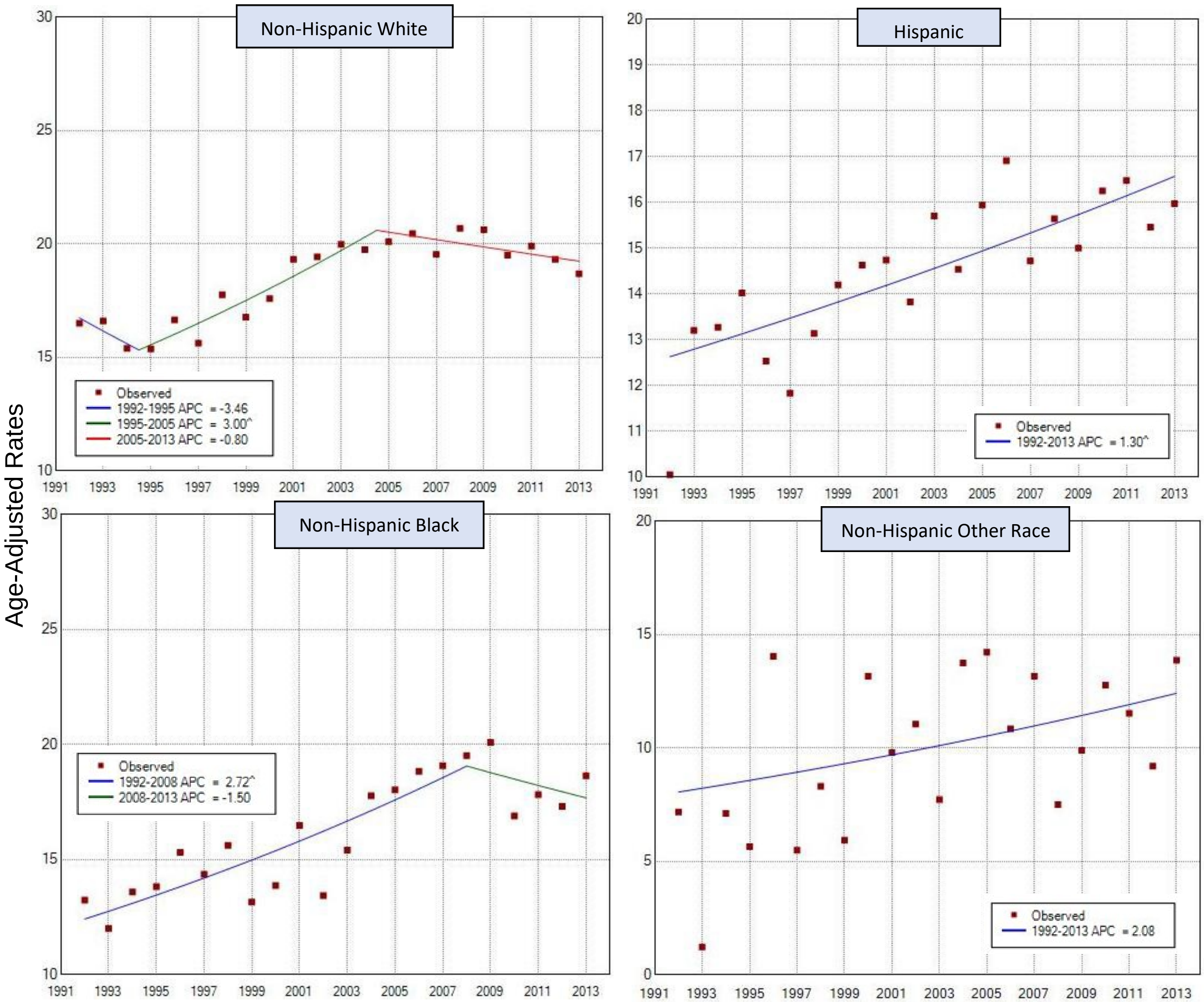
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

Since 1992, kidney cancer rates among most groups of women increased significantly with the exception of the non-Hispanic other race/ethnic group. This is consistent with national kidney incidence trends among women by ethnicity since 1999[12]. A significant decreasing trend has occurred among non-Hispanic White women beginning from 2008 at a rate of -3.71.

D.10. Male Kidney Cancer Trends

Figure 10. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Male Kidney Cancer by Race/Ethnicity

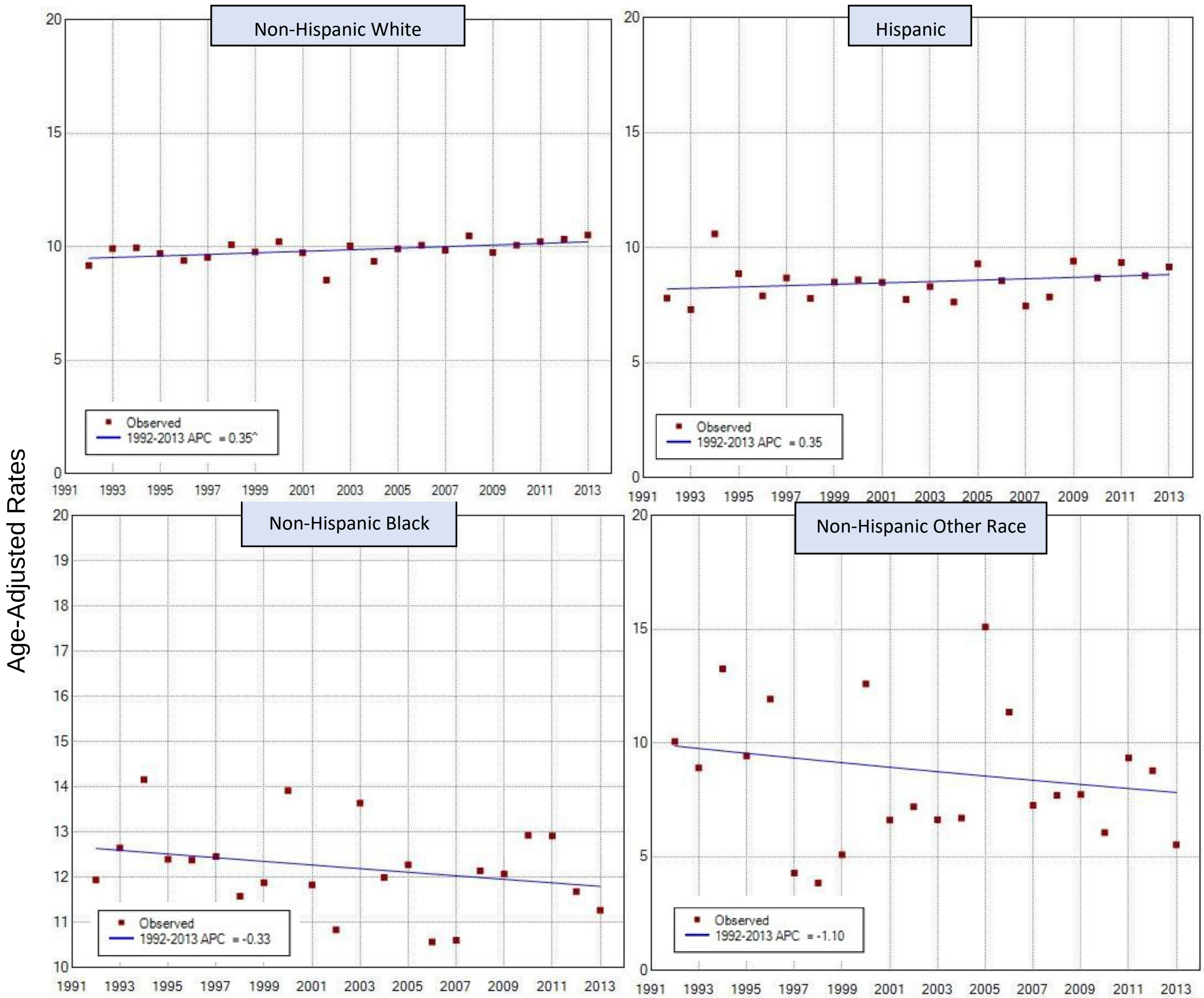


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t* test; *p* < .05).

Kidney cancer incidence rates among men vary depending on race/ethnic category and time period. Non-Hispanic White men experienced a significant increase in incidence between the years 1995-2005 (3.00 APC); non- Hispanic Black men showed significant increases between 1992 and 2008 (2.72 APC), and Hispanic men had a significant increasing trend since 1992 (1.30 APC). No change was observed among the category for non-Hispanic other race. Nationally, a significant increase in kidney cancer incidence trends among all male race and ethnic groups were observed between 1999 and 2008.[12]

D.11. Female Pancreatic Cancer Trends

Figure 11. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Pancreas Cancer by Race/Ethnicity



Abbreviations: APC, annual percent change
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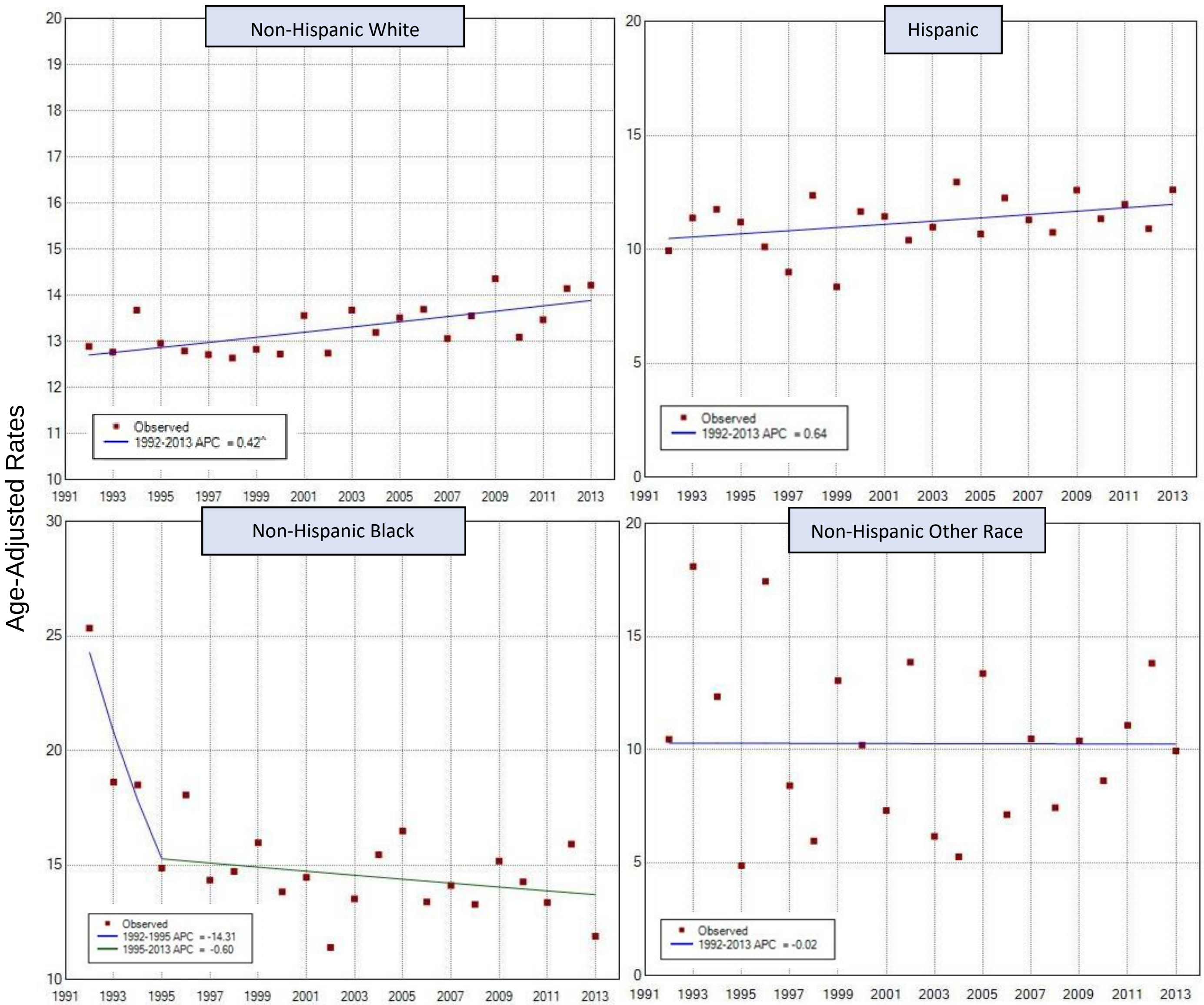
^ The APC is statistically significantly different from zero (2-sided *t*- test; *p*< .05).

There were slight changes in pancreatic cancer incidence trends among women, with a statistically significant increase among non-Hispanic White women (0.35 APC), and no statistical significant change in other race/ethnic groups. While nationally rates have increased significantly among all female groups combined, the increase is slight.[12]

D.12. Male Pancreatic Cancer Trends

Figure 12. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Male Pancreas Cancer by Race/Ethnicity

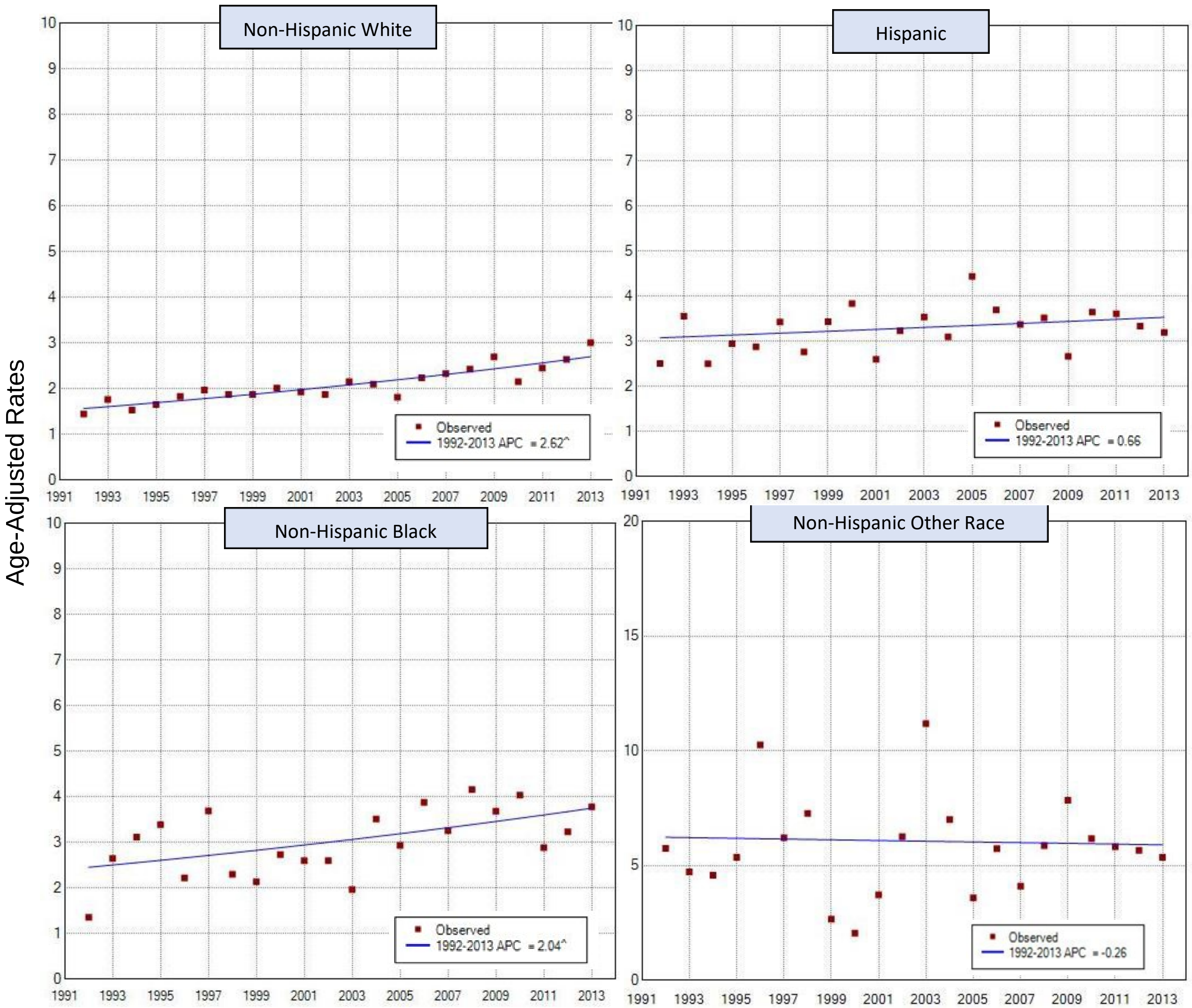


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

Pancreatic trends among men are similar to the trends among women, with non-Hispanic Whites demonstrating a statistically significant increase by race/ethnicity (0.42 APC). Nationally, between 1999 and 2008, a statistically significant increase was observed among non-Hispanic Whites.[12]

D.13. Female Liver Cancer Trends

Figure 13. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Liver Cancer by Race/Ethnicity

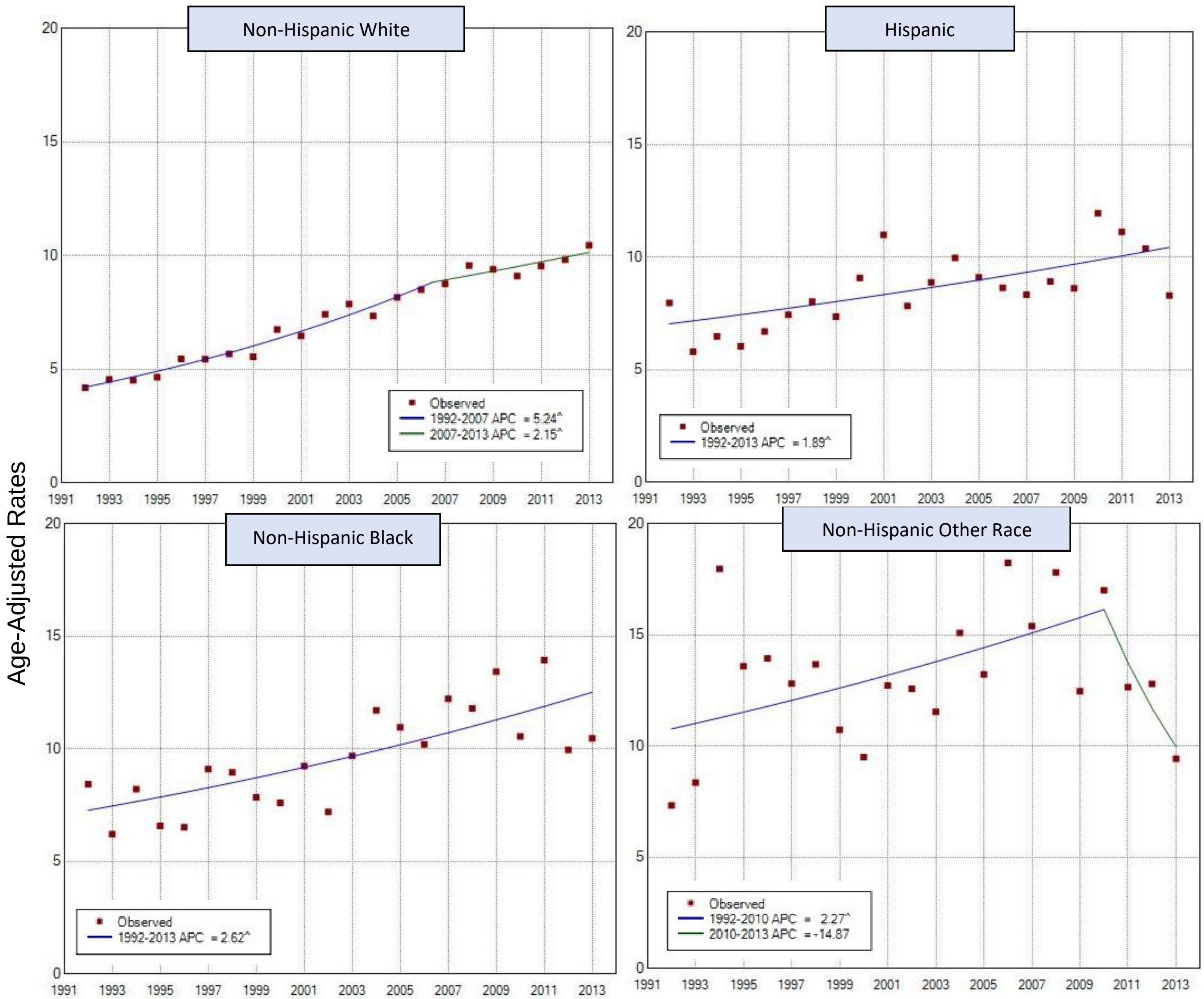


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

Liver cancer incidence trends among women increased significantly among non-Hispanic White women (2.62 APC) and non-Hispanic Black women (2.04 APC), with no observable changes among Hispanic and non-Hispanic other racial groups. Nationally, rates have increased significantly across most race/ethnic groups with the greatest increase among non-Hispanic Black women between 1999 and 2008.[12]

D.14. Male Liver Cancer Trends

Figure 14. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Male Liver Cancer by Race/Ethnicity

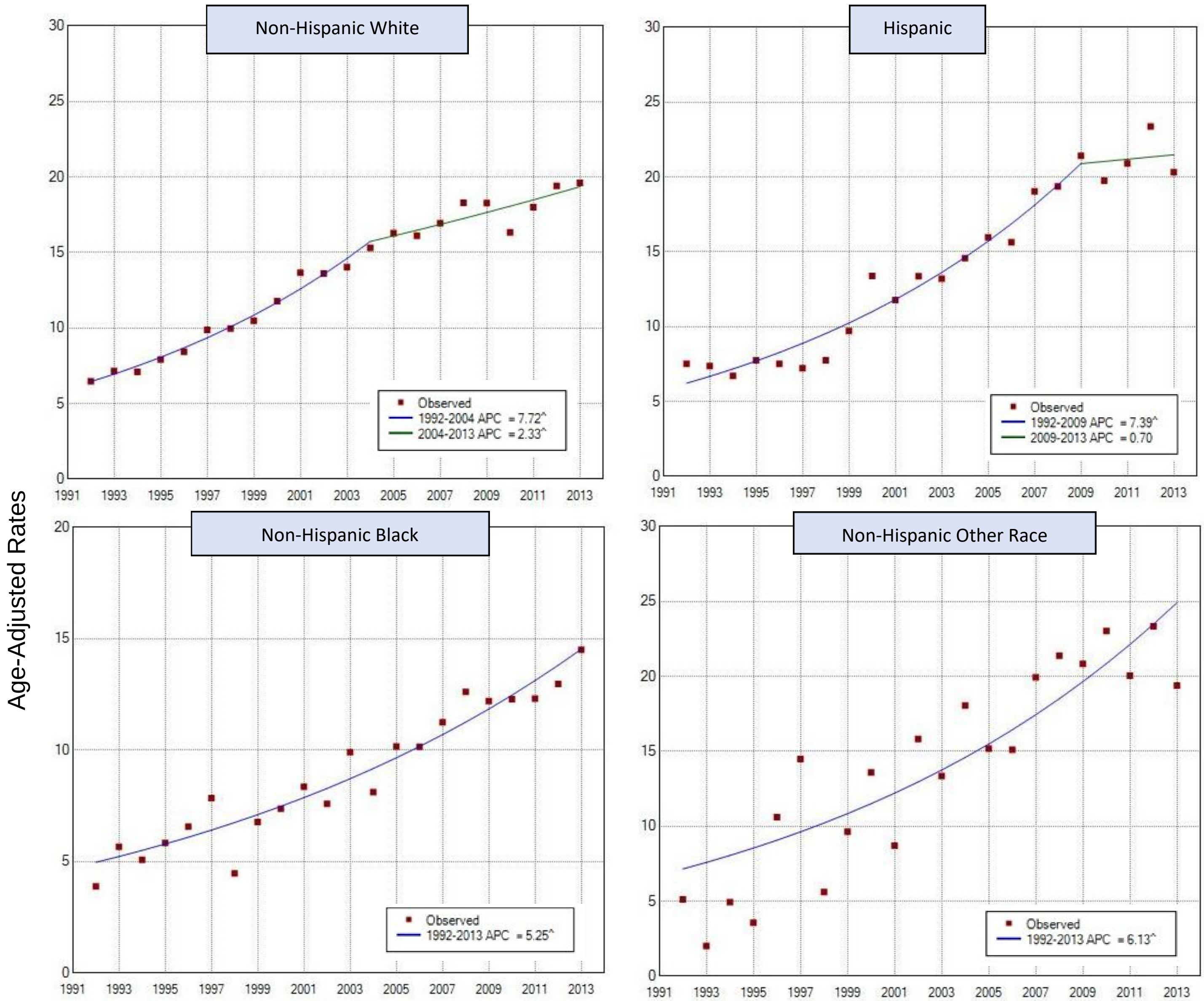


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; $p < .05$).

Liver cancer incidence trends among men increased steadily and significantly among all race/ethnic groups with the greatest increase occurring in non-Hispanic White men between the years 1992 and 2007 (5.24 APC). Nationally, rates have increased significantly across race/ethnic groups with the greatest increase among non-Hispanic Black men between 1999 and 2008.[12]

D.15. Female Thyroid Cancer Trends

Figure 15. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Thyroid Cancer by Race/Ethnicity

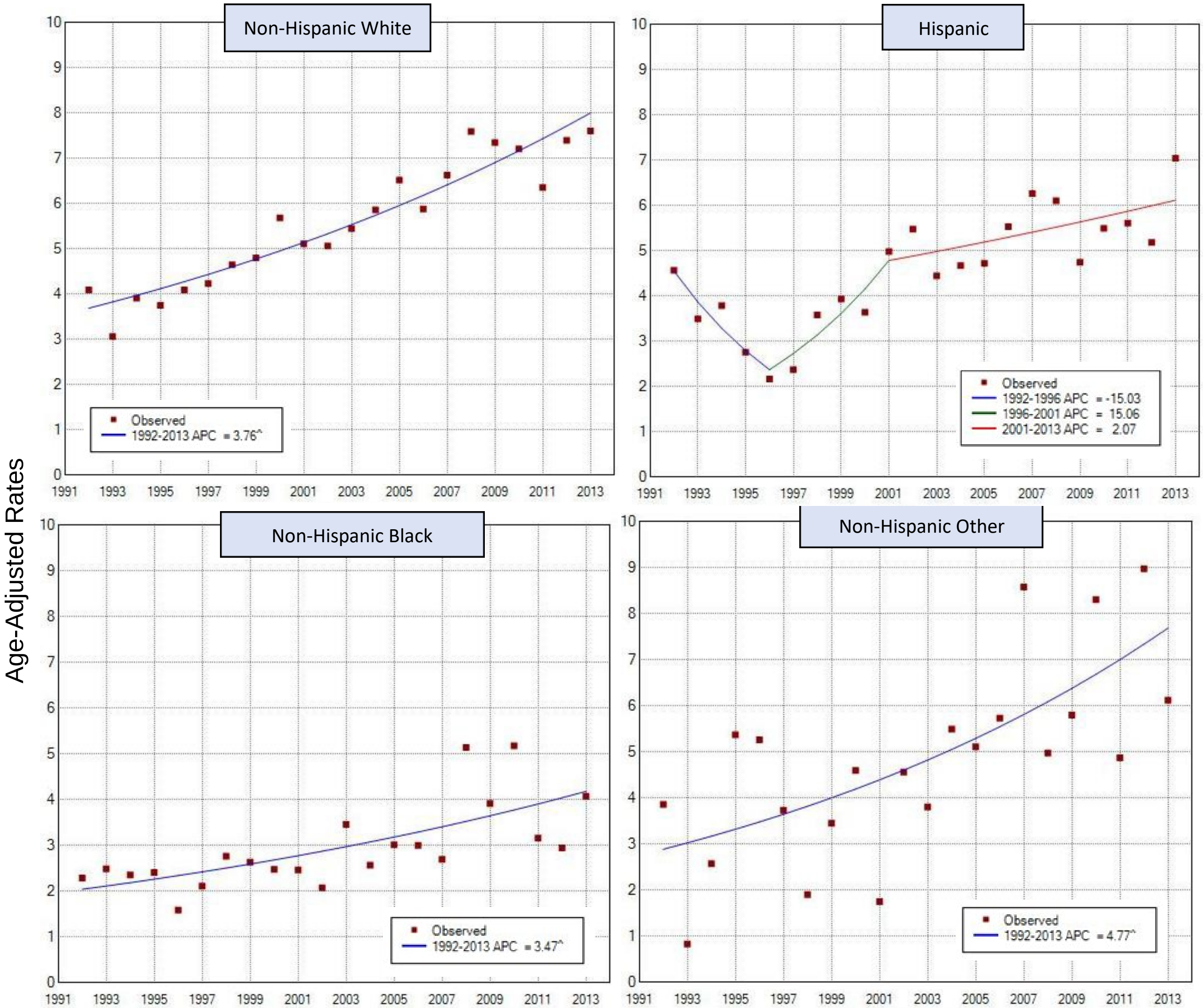


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; *p*< .05).

Comparative to other cancers, thyroid cancer trends increased dramatically among women of all race/ethnic groups with the highest significant increase occurring among non-Hispanic White women between 1992 and 2004 (7.72). Steady and significant increases are also observed among non-Hispanic Blacks (5.25 APC), non-Hispanic other race (6.13 APC) and Hispanics through 2009 (7.39 APC). This trend has also been observed nationally with similar average annual percent changes across race/ethnic groups.[12]

D.16. Male Thyroid Cancer Trends

Figure 16. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Male Thyroid Cancer by Race/Ethnicity

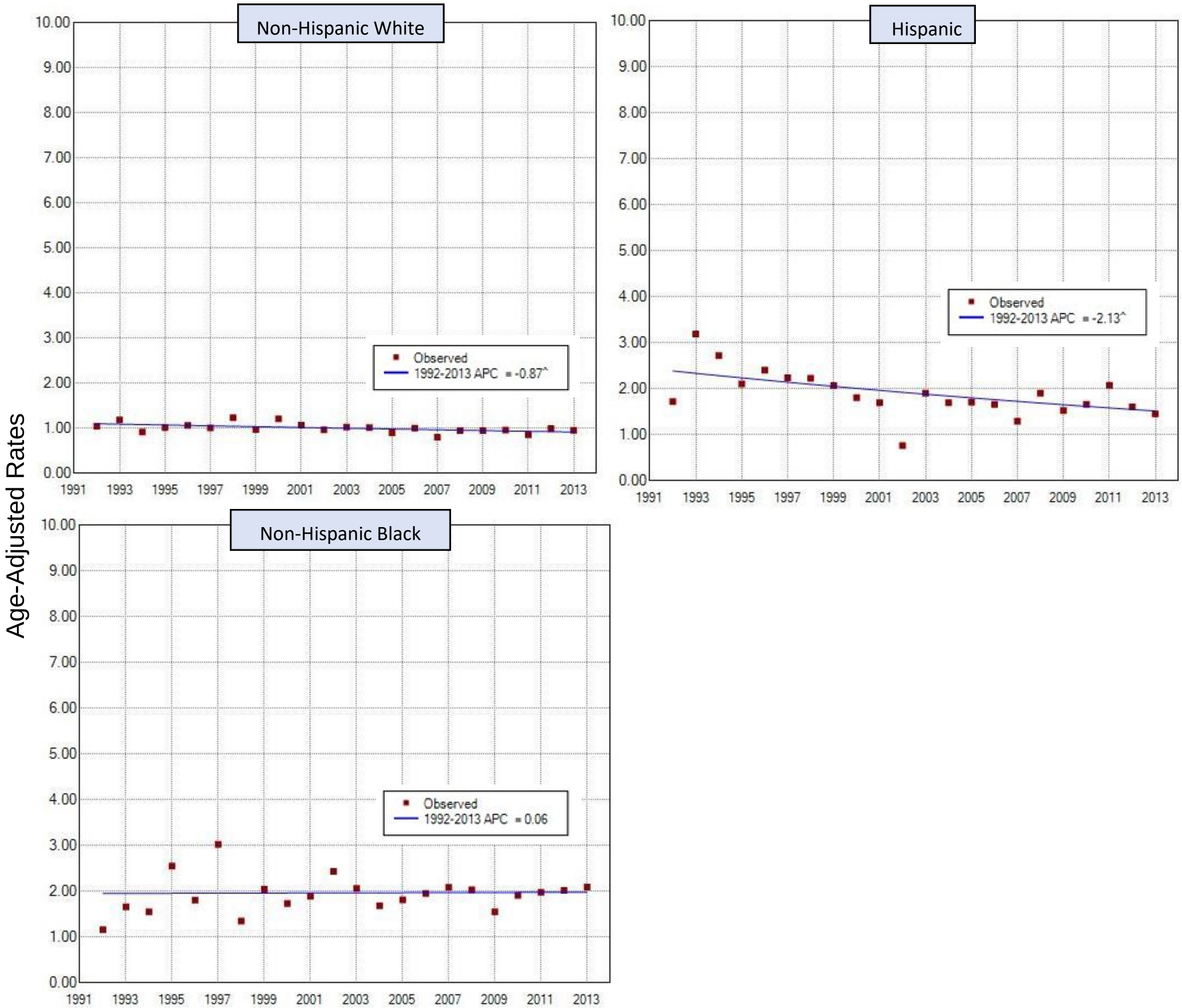


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*-test; *p* < .05).

Thyroid cancer trends among men increased significantly among non-Hispanic race/ethnic groups (3.76 non-Hispanic Whites, 3.47 non-Hispanic Blacks, 4.77 non-Hispanic other race), but have decreased significantly among Hispanics through 1996. Since 1996, no significant changes were been observed among Hispanic men. Nationally, between 1999 and 2008, significant increases were been observed among all race/ethnic groups with the exception of American Indian/Alaska Natives.[12]

D.17. Female Gallbladder Cancer Trends

Figure 17. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Female Gallbladder Cancer by Race/Ethnicity

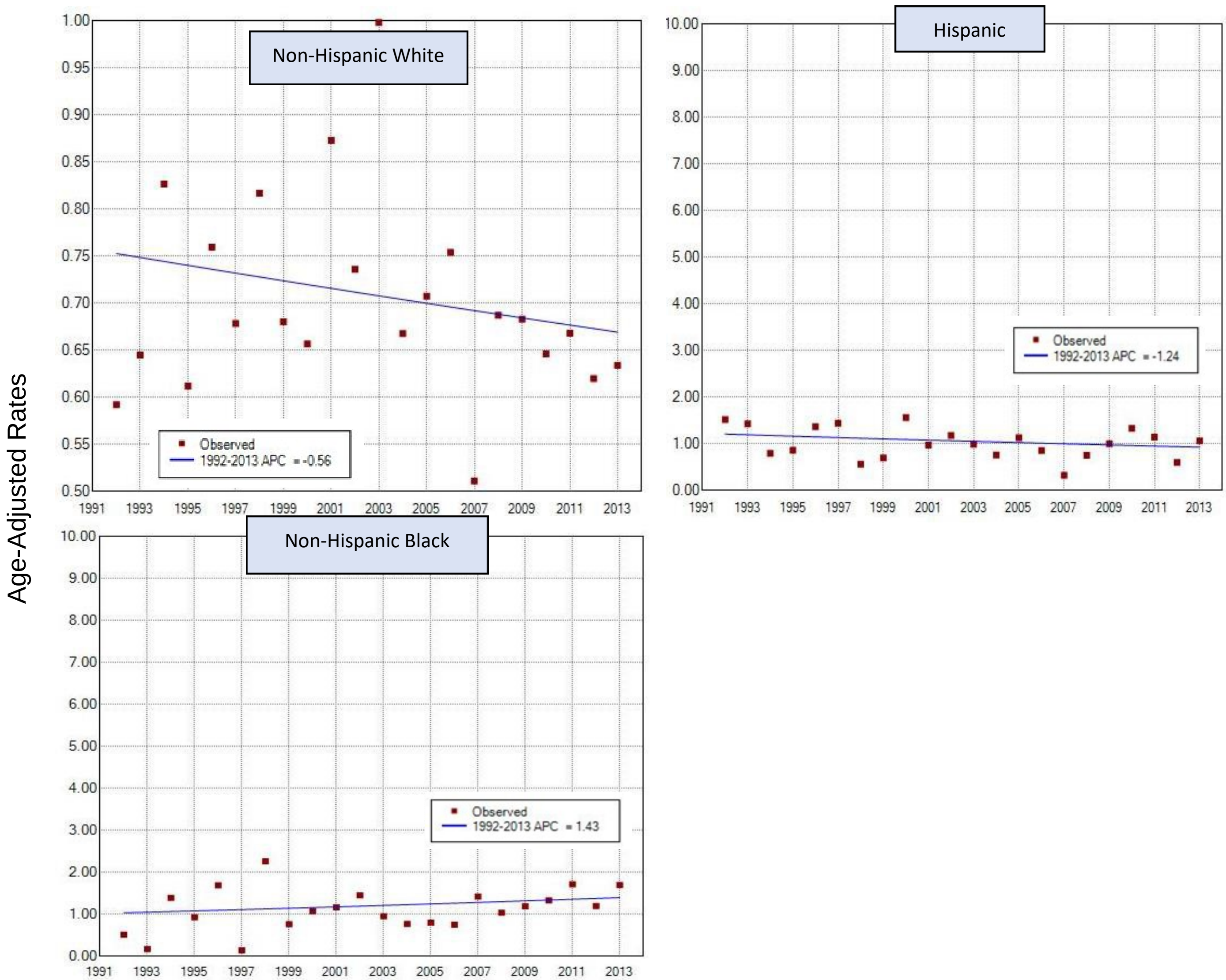


Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*- test; *p*< .05).

Gallbladder incidence trends decreased significantly, albeit slightly, among non-Hispanic White (-0.87 APC) and Hispanic women (-2.13 APC), with no change among non-Hispanic Blacks. No data are shown for non-Hispanic other race as trends could not be generated due to unstable rates for certain years. Nationally, gallbladder rates for women, race/ethic groups combined, have decreased significantly through 2008.[12]

D.18. Male Gallbladder Cancer Trends

Figure 18. Florida Cancer Incidence Rate Trends with Joinpoint Analysis from 1992-2013 for Male Gallbladder Cancer by Race/Ethnicity



Abbreviations: APC, annual percent change
The vertical axis displays age-adjusted rates for diagnosis years 1992-2013.
The APC is based on rates that were age-adjusted to the 2000 U.S. standard population (19 age groups).
^ The APC is statistically significantly different from zero (2-sided *t*-test; $p < .05$).

Since 1992, there have been no significant changes in gallbladder incidence among men of any race/ethnic groups. While rates have decreased among non-Hispanic White and Hispanic men, the changes were not statistically significant.

E. Body Mass Index by Cancer Site and Sex

E.1. Percent of Cancers by BMI Categories of Weight: Females 2011-2013

Figure 19. Percent of Cancers by Body Mass Index Categories of Weight among Females, Florida, 2011-2013

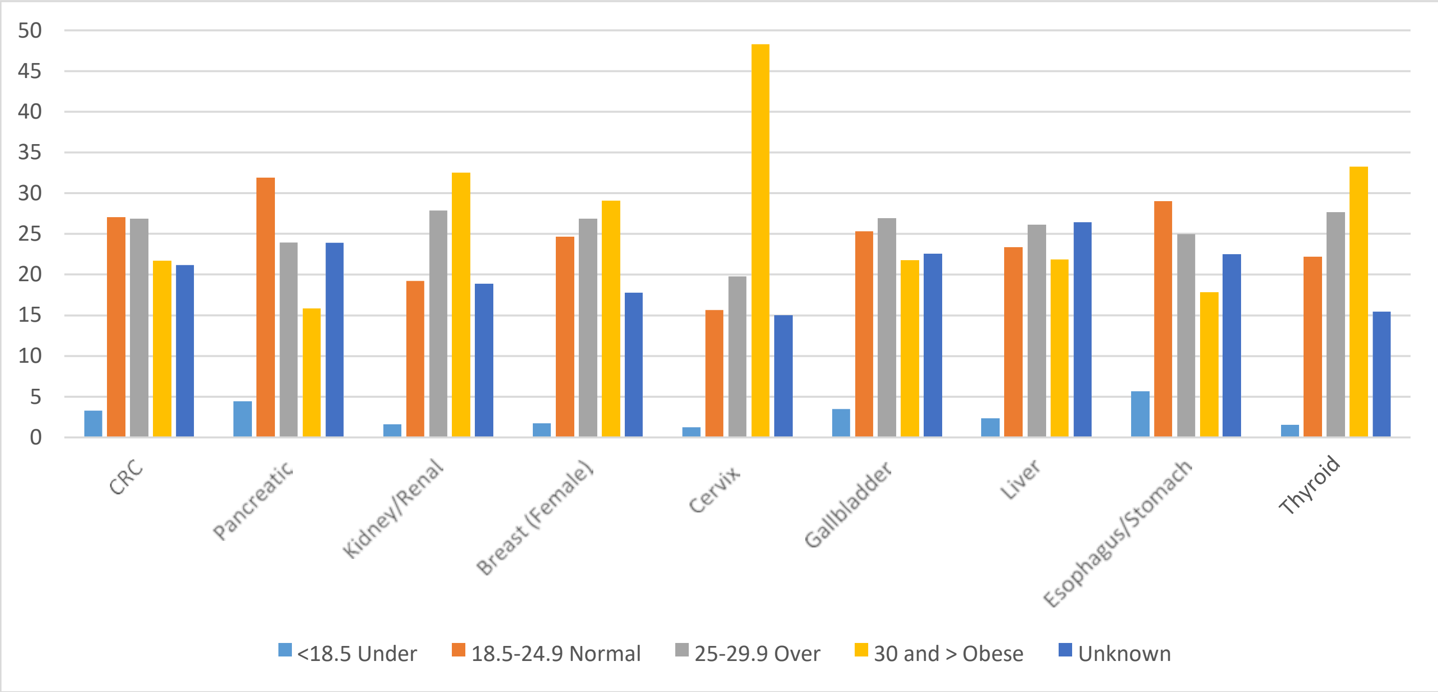


Table 1. Percent of Cancers by Body Mass Index Categories of Weight among Females, Florida, 2011-2013

BMI Weight Category	CRC	Pancreatic	Kidney Renal	Breast	Cervix	Gallbladder	Liver	Esophagus Stomach	Thyroid
<18.5 Under	4.6	5.8	2.3	1.7	1.3	3.7	3.4	8	1.6
18.5-24.9 Normal	29.6	32.7	22.3	24.6	15.7	26.9	26.1	30.7	24.5
25-29.9 Over	23.4	20.6	24.3	26.8	19.8	24.5	23.4	20.7	26
30 and > Obese	21.8	15.6	33.2	29.1	48.3	24.4	22.1	17.7	32.8
Unknown	20.6	25.4	17.9	17.8	15	20.5	25	23	15.3

The BMI categories of weight were calculated by cancer site and distributed proportionally into four categories; under- weight, normal, overweight, obese, and unknown.[20] The distribution of female cancer cases across BMI categories varied by cancer site. The number of females where the proportion of cases in the normal BMI category exceeded other categories was observed for colorectal, pancreatic, gallbladder, liver, and esophageal/stomach cancers. The number of females designated as 'obese' exceeded other BMI categories for thyroid, breast, kidney/renal, and cervical cancer. The greatest proportion of obesity relative to other categories was observed among women with cancer of the cervix; 48% relative to other categories.

E.2. Percent of Cancers by BMI Categories of Weight: Males 2011-2013

Figure 20. Percent of Cancers by Body Mass Index Categories of Weight among Males, Florida, 2011-2013

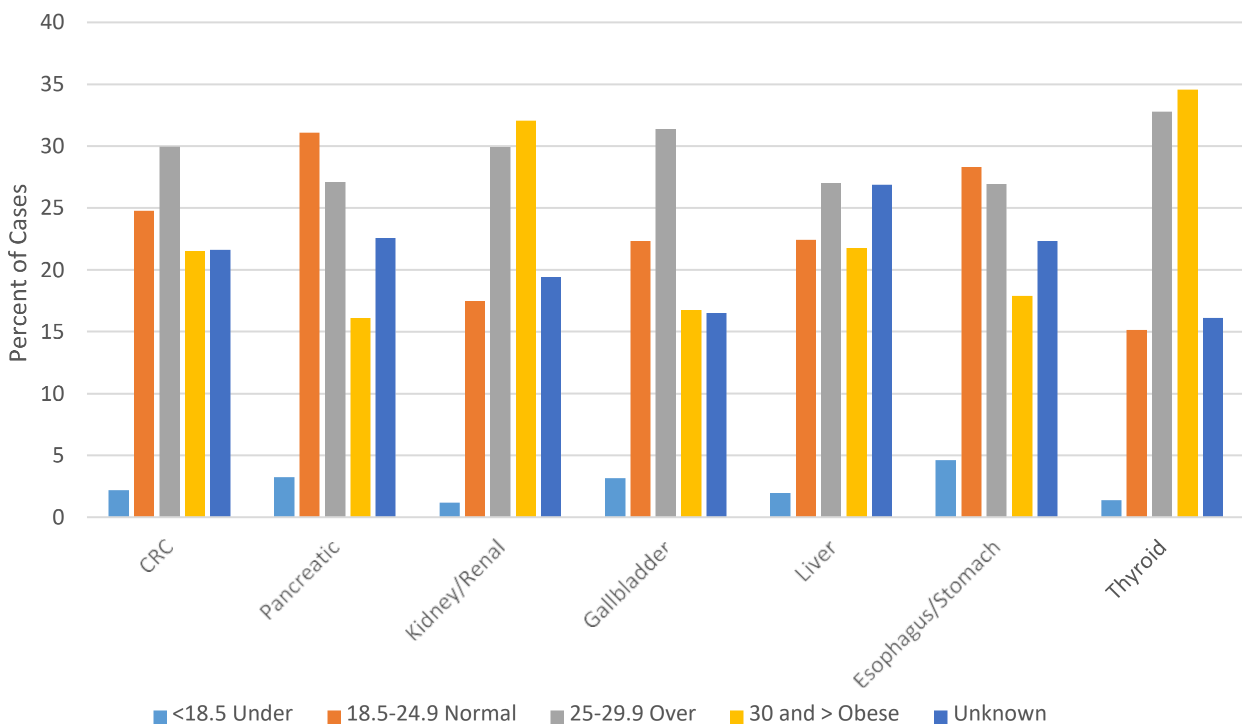


Table 2. Percent of Cancers by Body Mass Index Categories of Weight among Males, Florida, 2011-2013

BMI	CRC	Pancreatic	Kidney Renal	Gallbladder	Liver	Esophagus Stomach	Thyroid
<18.5 Under	2.2	3.2	1.2	3.1	2	4.6	1.4
18.5-24.9 Normal	24.8	31.1	17.5	22.3	22.4	28.3	15.2
25-29.9 Over	30	27.1	29.9	31.4	27.0	26.9	32.8
30 and > Obese	21.5	16.1	32.1	16.7	21.8	17.9	34.6
Unknown	21.6	22.6	19.4	16.5	26.9	22.3	16.1

The distribution of male cancer cases across BMI categories also varied by cancer site. The proportion of cases in the normal BMI category that exceeded other categories was observed for pancreatic, and esophageal/stomach cancers (31% and 28% respectively). Cancers with more cases in the overweight category were observed for colorectal, gallbladder, and liver cancers (24.8%, 31.4%, and 27% respectively). Cancers with cases predominantly in the obese category were observed for kidney/renal, and thyroid cancers (32.1% and 34.6% respectively).

F. Discussion

The present analysis examined and compared trends in weight-related cancers examined at the national level as reported in the 2011 Annual Report to the Nation on the Status of Cancer.[12] Cancers examined included esophageal and stomach, colorectal, kidney, pancreas, cervical, and post-menopausal female breast cancer.[12] An analysis of liver, thyroid, and gallbladder cancer trends was also conducted to assess evidence that the selected cancers were also associated with obesity.[10,13-15] Presented below is a comparison of findings with the 2011 Annual report, followed by a summary of findings for the additional cancers included in this report.

F.1. Comparison of Select Weight-Associated Incidence Trends in Florida with National Trends.

The 2011 Annual Report to the Nation on the Status of Cancer included detailed tables summarizing cancer trends for select cancers of interest. A table comparing these trends at the national level along with Florida findings is provided below. Several caveats should be noted: 1) the analyzed period for Florida was 1992-2013 compared to 1992-2008 for the national report; 2) race/ethnic specific findings are reported for Florida while overall rates irrespective of race and ethnicity is available at the national level; 3) comparison of results for esophageal cancer is not compared below given that the Florida analyses combined data with stomach cancer; and 4) pooled national results contain Florida cancer data as well. Significant sex-specific APC in cancer incidence are noted in Tables 3 and 4, along with corresponding years in which these trends were significant.

Among males the results for the United States were similar to other race/ethnic group findings reported for Florida (Table 3). Among non-Hispanic and Hispanic Floridians the APC reduction in colorectal and colon cancer was larger than observed nationally (-3.4- -5.0 versus -2.6- -2.7). Larger increases in pancreatic cancer were seen at the national level relative to non-Hispanic White Floridians (1.4 versus 0.4); however, kidney and renal cancer increases were larger for non-Hispanic Black and non-Hispanic White Floridians relative to the increased national trends (2.7-3.0 versus 2.2).

Table 3. Selected Weight-Associated Cancer Trends in Males: Overall US Trends (1992-2008) Versus Florida Race/Ethnic Specific Trends (1992-2013)

	SEER Trends 1992-2008*¶	Florida Trends 1992-2013¶		
	All Race/Ethnic Groups	Non-Hispanic White	Hispanic	Non-Hispanic Black
	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]
Colon and Rectum	1992-1995 [-2.6]	1992-1995 [-3.5] 2000-2010 [-4.7]	1999-2013 [-3.3]	1999-2013 [-2.5]
Colon	1992-1995 [-2.6] 1998-2008 [-2.7]	1992-1995 [-3.4] 2000-2010 [-5.0]	2000-2013 [-3.4]	1996-2013 [-2.4]
Pancreas	2002-2008 [1.4]	1992-2013 [0.4]		
Kidney and Renal Pelvis	1995-2008 [2.2]	1995-2005 [3.0]	1992-2013 [1.3]	1992-2008 [2.7]

*Data from Table 7 of the Annual Report to the Nation[12]
¶ Only trends at the p < 0.05 level are shown

Similar to findings for males, female Floridians experienced larger significant reductions in colon and colorectal rates relative to the nation as a whole; these significant reductions in Florida started in the year 2000 while significant albeit smaller reductions in the APC started in 1992 for the nation (Table 4). Also, similar to males was the smaller relative increases in pancreatic cancer in Florida compared to national trends (0.4 versus 1.4). The significant increases in kidney and renal cancers were smaller in Hispanics and non-Hispanic Blacks in Florida (1.8) relative to non-Hispanic Floridians and the nation as a whole (2.7 and 3.3, respectively). Interestingly, rates for kidney and renal cancer have recently decreased dramatically among non-Hispanic White Floridians (-3.7 in years 2008-2013).

Breast cancer findings in Florida varied across race/ethnic groups. There were significant increases among non-Hispanic Black and "other" race/ethnic groups (0.5 and 2.0, respectively), while there was a small reduction in breast cancer rates among Hispanic Floridians over the same time period (-0.6; over years 1992-2013). Results for non-Hispanic White Floridians more closely mirror results for females nationally with initial increases in the1990s followed by reductions in the early 2000s. Of note, the more recent data in Florida not available in the 2011 Annual Report to the Nation, indicate a small but statistically significant increase in breast cancer rates in Florida. Finally, there were variations in trends for cervical cancer both when comparing rates to the nation as a whole and across race ethnic groups in Florida. There were no significant trends reported nationally while there were significant large reductions seen for non-Hispanic Whites and non-Hispanic Blacks (-2.6- -2.8) in Florida with more modest reductions in Hispanics over the entire examined time period (-0.6; years 1992- 2013). Non-Hispanic White Floridians have reversed their earlier improvement in rates, showing recent small significant increases in the APC (0.9; years 2004-2014).

Table 4. Selected Weight-Associated Cancer Trends in Females: Overall US Trends (1992-2008) Versus Florida Race/Ethnic Specific Trends (1992-2013)

	SEER Trends 1992-2008*¶	Florida Trends 1992-2013¶			
	All Race/Ethnic Groups	Non-Hispanic White	Hispanic	Non-Hispanic Black	Non-Hispanic Other
	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]
Colon and Rectum	1992-1995 [-1.9] 1998-2008 [-2.0]	1992-1995 [-2.6] 2000-2010 [-4.0]	2000-2013 [-3.9]	2001-2013 [-3.3]	1995-2013 [-2.4]
Colon	2000-2008 [-2.3]	2000-2013 [-3.8]	2000-2013 [-3.9]	2003-2013 [-3.6]	
Pancreas	2000-2008 [1.4]	1992-2013 [0.4]			
Kidney and Renal Pelvis	1998-2008 [3.3]	1992-2008 [2.7] 2008-2013 [-3.7]	1992-2013 [1.8]	1992-2013 [1.8]	
Breast (aged >= 50)	1992-1999 [1.7] 1999-2004 [-2.9]	1992-2001 [1.1] 2001-2005 [-5.2] 2005-2013 [0.7]	1992-2013 [-0.6]	1992-2013 [0.5]	1992-2013 [2.0]
Cervix		2000-2004 [-2.7] 2004-2013 [0.9]	1992-2013 [-0.6]	1992-2005 [-2.6] 2009-2013 [-2.8]	

* Data from Table 7 of the Annual Report to the Nation [12]
¶ Only trends at the $p < 0.05$ level are shown

F.2. Trends in Combined Esophageal/Stomach Cancer and other Potential Weight-Associated Cancers in Florida.

A summary of trends in other cancers potentially associated with excess weight is presented in tables 5 and 6. For males there were significant reductions in the combined category for esophageal and stomach cancers for non-Hispanic Whites and Hispanics (range: -1.0 -- -1.2) with much larger decreases noted for non-Hispanic Blacks (-3.9) over all assessed years (table 5). There were no significant trends for gallbladder but significant and large APC increases of at least 2.2 noted for thyroid and liver cancer for all groups with the exception of Hispanics who had a smaller but significant increase of 1.9 for liver cancer.

Table 5. Additional Potential Weight-Associated Cancer Trends in Males: Florida Race/Ethnic Specific Trends (1992-2013)

	Florida Trends 1992-2013¶			
	Non-Hispanic White	Hispanic	Non-Hispanic Black	Non-Hispanic Other
	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]
Esophagus/Stomach	1992-2013 [-1.2]	1992-2013 [-1.0]	1992-2013 [-3.9]	
Gallbladder				
Liver	1992-2007 [5.2] 2007-2013 [2.2]	1992-2013 [1.9]	1992-2013 [2.6]	1992-2010 [2.3]
Thyroid	1992-2013 [3.8]		1992-2013 [3.5]	1992-2013 [4.8]

¶ Only trends at the $p < 0.05$ level are shown

Similar to findings for males, non-Hispanic White, Hispanic, and non-Hispanic Blacks experienced significant reductions in esophageal/stomach cancer. Unlike their male counterparts, non-Hispanic White and Hispanic females had significant reductions in gallbladder cancer. For non-Hispanic Whites there was a significant increase in liver cancer across all assessed years (2.6); there were also dramatic increases in thyroid cancer across all race/ethnic groups.

Table 6. Additional Potential Weight-Associated Cancer Trends in Females: Florida Race/Ethnic Specific Trends (1992-2013)

	Florida Trends 1992-2013¶			
	Non-Hispanic White	Hispanic	Non-Hispanic Black	Non-Hispanic Other
	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]	Trend Years [APC]
Esophagus/Stomach	1992-2013 [-1.9]	1992-2013 [-1.1]	1992-2013 [-3.3]	
Gallbladder	1992-2013 [-0.9]	1992-2013 [-2.1]		
Liver	1992-2013 [2.6]		1992-2013 [2.0]	
Thyroid	1992-2004 [7.7] 2004-2013 [2.3]	1992-2009 [7.4]	1992-2013 [5.3]	1992-2013 [6.1]

¶ Only trends at the $p < 0.05$ level are shown

F.3. Summary

F.3.1. Favorable Cancer Trends in Florida

In comparison to national trends, Floridians experienced even more favorable reductions in colorectal cancer rates (tables 3 and 4). Furthermore, the three-major race/ethnic groups in Florida experienced these reductions. One possible explanation for these favorable trends is efforts in Florida to target high-risk population groups to enhance screening efforts for colorectal cancer. A second explanation could involve the introduction of Medicare-covered colonoscopies beginning in the late 1990s.[21] Although these downward trends are quite encouraging, it is important to note that these trends may have been even more favorable had it not been for the obesity epidemic in the United States.

All three major race/ethnic groups in Florida also experienced significant reductions in combined esophagus/stomach cancer analyses. These improvements were largely similar to those seen nationally; in the most recent Report to the Nation the APC for stomach cancer only was -1.7 for men and women all race/ethnic groups combined for years 1992-2012 (Table 1[22]). For our combined esophagus/stomach category the APC for non-Hispanic White females were similar for female stomach cancer rates nationally (- 1.9) and somewhat lower for male Floridians (-1.2). In Florida, non-Hispanic Black males had a relatively larger reduction in this combined cancer category (-3.3), although large APC reductions were also reported for Blacks (irrespective of ethnicity) for stomach and esophageal cancer at the national level (Table 3[22]: APC -2.3 and -5.3, respectively). Therefore, although difficult to directly compare, results for Florida seem to largely mirror those seen nationally, and may be reflective of worldwide reductions in stomach cancer incidence rates over the past century.[23] Increased recognition of the need to treatment of *H. pylori* infections for the prevention of stomach cancer and treatment of gastroesophageal reflux disease for the prevention of esophageal cancer, along with continued reductions in U.S. smoking rates may be contributing to reductions in stomach and esophageal cancer in Florida and in the U.S. despite the countervailing risk enhancing effects of obesity for both of these cancers.[23,24] For example, in one case-control study the population attributable fractions for body mass index above the lowest quartile was 41.1% (95% CI = 23.8% to 60.9%) for esophageal adenocarcinomas, and 19.2% (95% CI = 4.9% to 52.0%) for gastric cardia adenocarcinomas.[25]

F.3.2. Unfavorable Cancer Trends in Florida

Kidney and renal pelvis cancers are increasing across the Nation and in Florida. Among male Floridians this rate of increase exceeds the national overall trend (APC 2.2) among non-Hispanic Whites (3.0) and non-Hispanic Blacks (2.7). However, the rates of increase among female Floridians was less than that seen nationally. Furthermore, there was a recent significant reduction in rates for non-Hispanic Whites for years 2008-2013 (-3.7). It is possible that these increases are due, in part, to better detection given advances in imaging technology.[26] However, the population attributable fractions for overweight and obesity is estimated to be 12.5% and 23.4%, respectively, based on meta-analysis of U.S.-based studies.[27] The only other established modifiable risk factor for kidney and renal pelvis cancers is cigarette smoking[28], the prevalence of which has decreased in the U.S. for decades.[29] In Florida, the largest proportion of renal cancer cases occurred among individuals that identified as being obese for both males, and females (Figures 19 and 20).

The results from the analysis indicated that further investigation should be conducted to assess correlation between an increase in obesity rates and the increase of cancer incidence in Florida.

During this time period in Florida, liver cases increased in males in all race/ethnic groups including, non-Hispanic other. The increases ranged from 1.9-2.6 across groups, with a large spike in rates for non-Hispanic White males in years 1992-2007 (APC=5.2). For females significant increases were noted for non-Hispanic Whites (2.6) and non- Hispanic Blacks (2.0) across all survey years. Nationally, for all race/ethnic groups combined, the APC for liver cancer for men was 4.6 across years 1992-1999 while there was a small but significant decline in female cancer rates across the same time period (Table 1[22]). Thus, rates for males were generally similar to the national rates, while rates for non-Hispanic White and Black females rose against the national backdrop of slowly declining rates for females irrespectively of race/ethnicity. Part of the increases seen in Florida and nationally are thought to reflect a cohort effect resulting from rising rates of Hepatitis B and C which infections peaked decades earlier.[30] However, the U.S. population-attributable fraction (PAF) for obesity and/or diabetes for Hepatocellular Carcinoma is 36.6%, which is higher than the PAFs for Hepatitis B and C infections (6.3% and 22.4%, respectively).[31] A recent update of PAF's for Hepatocellular Carcinoma included obesity as part of a broader constellation of metabolic disorders (e.g., diabetes, impaired glucose tolerance, metabolic syndrome, nonalcoholic fatty liver disease) and confirmed that this constellation is the most important contributor to the U.S. burden of Hepatocellular Carcinoma and that proportion of attributable cases have increased in the past decade[32]. However, it is not clear what role obesity may be playing in liver cancer rates in Florida. Of note, in Florida there was no clear dose response pattern when comparing BMI categories for those diagnosed with liver cancer (Figures 19 and 20).

In Florida, there have been large increases in female thyroid cases in all race/ethnic groups including, non-Hispanic other, which exceeds that of any other cancer trends noted in the present report (APC range 5.3-7.7, except for recent trends in non-Hispanic Whites= 2.3). Among males the increases were not as consistent or dramatic and ranged from 3.5-4.8 among all race/ethnic groups excluding Hispanics. Nationally, rates of thyroid cancer have been rising for women irrespective of race/ethnicity, although the rate of this increase has varied over time: 1992- 1999=4.1; 1999-2009=6.9; 2009-2012=1.4 (Table 1[22]). Thus, rate increases among women were roughly comparable to national rates. National rates for men declined 3.0 for years 1992-1995 before rising by 5.2 for years 1995-2012 (Table 1[22]), suggesting that the rate of increase in Florida is roughly comparable.

The incidence of thyroid cancer has been increasing for decades, due in large part to the increased detection of small papillary cancers.[33] More recent analyses documenting variation in the detection of small and larger tumors across race/ethnic subgroups raise the possibility that diagnostic advances and increased surveillance cannot explain all of the observed increase in rates.[34] Increases in obesity rates could be one possible explanation given that high BMI is associated with chronic inflammatory states which increase insulin-like growth factor-1 levels, which are implicated in thyroid cancer risk.[14] However, an analysis of European studies revealed low estimated population attributable risks for obesity for men and women (8.0 and 7.8, respectively).[35] Other environmental exposures, such as medical radiation exposures and environmental pollutant exposures have been suggestive but definitive evidence to support these potential risk factors is largely lacking.[36]

F.4. Limitations

Several study limitations should be noted. Although the FCDS has received Gold Certification from the North American Association of Central Cancer Registries (NAACCR) since 2003, all cancer registry data can be limited by the accuracy of completeness of the data. Cancer records from the Florida Veteran's Administration medical facilities are presently not obtained by the FCDS. The denominator data needed for the calculation of incidence rates was based on U.S. Census estimates, which can also be subject to inaccuracies.

The selection of weight-related cancer sites was limited to ICD-0-3 categories and did not include criteria based on histology. Due to rate calculation constraints the analysis was limited to the combining of certain cancer sites, such as esophagus and stomach. Indications in the literature point to the association of overweight and obesity to adenocarcinomas of the esophagus.[37-39] This analysis was not performed in this report, which inhibits direct comparison to existing literature. Furthermore, specific parts of the stomach have been correlated with obesity and overweight in particular gastric cardia adenocarcinoma.[40,41] This report includes all subsites of the stomach, which may also prevent direct comparisons to other publications.

Finally, calculation of body mass index was limited by the case completeness of height and weight data. As shown in the data tables, the completeness range of these data items were between 75% and 85% depending on site and sex. Data collection for these fields began in 2011 and with each additional reporting year the percent completeness improves. While these data do not undergo quality control review, we included them in this report as an initial assessment of potential trends with relation to cancer incidence.

F.5. Public Health Implications

According to the National Academy Press publication, *The Unequal Burden of Cancer*: "The development of sound cancer prevention and control strategies begins with an all-encompassing cancer surveillance effort."[42] Cancer registry data are a vital component of this surveillance effort as reflected in this current report, which documents trends in weight-associated cancers. It is important to monitor cancer trends as underlying risks, such as the obesity epidemic in the U.S., are often in a state of flux. There is recent evidence that the rates of increase in obesity are slowing, which could, in turn, influence future cancer incidence trends.[7] Continued monitoring of cancer trends is clearly warranted.

It is important to note the reductions in colorectal cancer incidence in Florida that exceeds national trends. While the reasons for this are unclear screening efforts combined with the removal of polyps can lead to reduced colorectal cancer incidence,[43] and efforts to increase screening rates may be playing a role in the Florida colorectal cancer trends. The unfavorable trends of kidney cancer in Florida may be related, in part to the increased rates of obesity although analyses undertaken in this report are only suggestive of this possibility. Additional studies with different research designs are needed in order to better characterize risk for this cancer (e.g., case-control, longitudinal). Liver cancer rates for female non-Hispanic White and Black female Floridians are increasing against a backdrop of declining rates nationally. Promotion of these findings, and perhaps the findings for renal cancers could be incorporated into educational campaigns in order to educate Floridians about the role that obesity plays in the development of cancer.

G. Literature Cited

1. Fontaine KR, Redden DT, Wang C, Westfall AO, Allison DB. Years of life lost due to obesity. *JAMA.* 2003;289(2):187-193.

2. Prospective Studies C, Whitlock G, Lewington S, et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *Lancet.* 2009;373(9669):1083-1096.
3. Twig G, Yaniv G, Levine H, et al. Body-Mass Index in 2.3 Million Adolescents and Cardiovascular Death in Adulthood. *The New England journal of medicine.* 2016.
4. Zalesin KC, Franklin BA, Miller WM, Peterson ED, McCullough PA. Impact of obesity on cardiovascular disease. *Med Clin North Am.* 2011;95(5):919-937.
5. Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet.* 2008;371(9612):569-578.
6. Arnold M, Pandeya N, Byrnes G, et al. Global burden of cancer attributable to high body-mass index in 2012: a population-based study. *Lancet Oncol.* 2015;16(1):36-46.
7. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA.* 2014;311(8):806-814.
8. CDC. Data, Trends, and Maps. 2016; http://www.cdc.gov/obesity/data/prevalence-maps.html. Accessed March 20, 2016.
9. ACS. Cancer Facts & Figures 2016. http://www.cancer.org/acs/groups/content/@research/documents/document/acspc-047079.pdf. 2016.
10. Wolin KY, Carson K, Colditz GA. Obesity and cancer. *Oncologist.* 2010;15(6):556-565.

11. NCI. *Building on Opportunities in Cancer Research. An Annual Plan and Budget Proposal for Fiscal Year 2016.* http://www.cancer.gov/about-nci/budget/annual-plan/nci-plan-2016.pdf*.*

12. Eheman C, Henley SJ, Ballard-Barbash R, et al. Annual Report to the Nation on the status of cancer, 1975-2008, featuring cancers associated with excess weight and lack of sufficient physical activity. *Cancer.* 2012;118(9):2338-2366.
13. Marengo A, Rosso C, Bugianesi E. Liver Cancer: Connections with Obesity, Fatty Liver, and Cirrhosis. *Annu Rev Med.* 2016;67:103-117.
14. Pazaitou-Panayiotou K, Polyzos SA, Mantzoros CS. Obesity and thyroid cancer: epidemiologic associations and underlying mechanisms. *Obes Rev.* 2013;14(12):1006-1022.

15. Wang F, Wang B, Qiao L. Association between obesity and gallbladder cancer. *Front Biosci (Landmark Ed).* 2012;17:2550-2558.

16. Fritz A, Percy C, Jack A. *International classification of diseases of oncology.* Geneva: World Health Organization; 2000.
17. Ries LAG, Harkins D, Krapcho M, et al. SEER Cancer Statistics Review, 1975-2003, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2003/, based on November 2005 SEER data submission, posted to the SEER web site, 2006.

18. *Surveillance, Epidemiology, and End Results (SEER) program. SEER*Stat 6.5.1. Available at:* http://www.seer.cancer.gov*. (accessed April 15, 2009).* National Cancer Institute; 2009.

19. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Stat Med.* 2000;19(3):335-351.
20. Centers for Disease Control and Prevention. About Adult BMI. http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html (accessed May 7, 2016).
21. CMS. MLN Matters. Colorectal Cancer: Preventable, Treatable, and Beatable: Medicare Coverage and Billing for Colorectal Cancer Screening. Center for Medicare and Medicaid Services. February 02, 2006. MM Article # SE0613. Accessed 07-01-16. https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNMattersArticles/downloads/SE0613.pdf. 2006.
22. Ryerson AB, Eheman CR, Altekruse SF, et al. Annual Report to the Nation on the Status of Cancer, 1975-2012, featuring the increasing incidence of liver cancer. *Cancer.* 2016;122(9):1312-1337.

23. Karimi P, Islami F, Anandasabapathy S, Freedman ND, Kamangar F. Gastric cancer: descriptive epidemiology, risk factors, screening, and prevention. *Cancer Epidemiol Biomarkers Prev.* 2014;23(5):700-713.
24. Vaughan TL, Fitzgerald RC. Precision prevention of oesophageal adenocarcinoma. *Nature Reviews Gastroenterology & Hepatology.* 2015;12(4):243-248.
25. Engel LS, Chow WH, Vaughan TL, et al. Population attributable risks of esophageal and gastric cancers. *J Natl Cancer Inst.* 2003;95(18):1404-1413.
26. Weikert S, Ljungberg B. Contemporary epidemiology of renal cell carcinoma: perspectives of primary prevention. *World J Urol.* 2010;28(3):247-252.
27. Wang Y, Chen X, Song Y, Caballero B, Cheskin LJ. Association between obesity and kidney disease: a systematic review and meta-analysis. *Kidney Int.* 2008;73(1):19-33.
28. Lipworth L, Tarone RE, McLaughlin JK. The epidemiology of renal cell carcinoma. *J Urol.* 2006;176(6 Pt 1):2353-2358.
29. Trends in Current Cigarette Smoking Among High School Students and Adults, United States, 1965–2014. Centers for Disease Control and Prevention. http://www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/ (accessed May 7, 2016)
30. Bosch FX, Ribes J, Diaz M, Cleries R. Primary liver cancer: worldwide incidence and trends. *Gastroenterology.* 2004;127(5 Suppl 1):S5-S16.
31. Welzel TM, Graubard BI, Quraishi S, et al. Population-attributable fractions of risk factors for hepatocellular carcinoma in the United States. *Am J Gastroenterol.* 2013;108(8):1314-1321.
32. Makarova-Rusher OV, Altekruse SF, McNeel TS, et al. Population attributable fractions of risk factors for hepatocellular carcinoma in the United States. *Cancer.* 2016.
33. Davies L, Welch HG. Increasing incidence of thyroid cancer in the United States, 1973-2002. *JAMA.* 2006;295(18):2164-2167.
34. Enewold L, Zhu K, Ron E, et al. Rising thyroid cancer incidence in the United States by demographic and tumor characteristics, 1980-2005. *Cancer Epidemiol Biomarkers Prev.* 2009;18(3):784-791.
35. Renehan AG, Soerjomataram I, Tyson M, et al. Incident cancer burden attributable to excess body mass index in 30 European countries. *Int J Cancer.* 2010;126(3):692-702.
36. Vigneri R, Malandrino P, Vigneri P. The changing epidemiology of thyroid cancer: why is incidence increasing? *Curr Opin Oncol.* 2015;27(1):1-7.
37. Chow WH, Blot WJ, Vaughan TL, et al. Body mass index and risk of adenocarcinomas of the esophagus and gastric cardia. *J Natl Cancer Inst.* 1998;90(2):150-155.
38. American Cancer Society. Esophagus Cancer. What is cancer of the esophagus? Accessed 06-01-16. http://www.cancer.org/acs/groups/cid/documents/webcontent/003098-pdf.pdf. 2016.
39. National Cancer Institute. Obesity and Cancer Risk. Accessed 06-01-16. http://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/obesity-fact-sheet - q8. 2016.
40. Lagergren J, Bergstrom R, Lindgren A, Nyren O. Symptomatic gastroesophageal reflux as a risk factor for esophageal adenocarcinoma. *The New England journal of medicine.* 1999;340(11):825-831.
41. American Cancer Society. Stomach Cancer. What is stomach cancer? Accessed 06-01-16. http://www.cancer.org/acs/groups/cid/documents/webcontent/003141-pdf.pdf*.*
42. Haynes ME, Smedley BD, eds. *The Unequal Burden of Cancer: An Assessment of NIH Research and Programs for Ethnic Minorities and the Medically Underserved.* New York: National Academy Press; 1999.
43. Pan J, Xin L, Ma YF, Hu LH, Li ZS. Colonoscopy Reduces Colorectal Cancer Incidence and Mortality in Patients With Non-Malignant Findings: A Meta-Analysis. *Am J Gastroenterol.* 2016;111(3):355-365.

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