

# Investigation of Age-Related Incidence Patterns in Adult Cancers

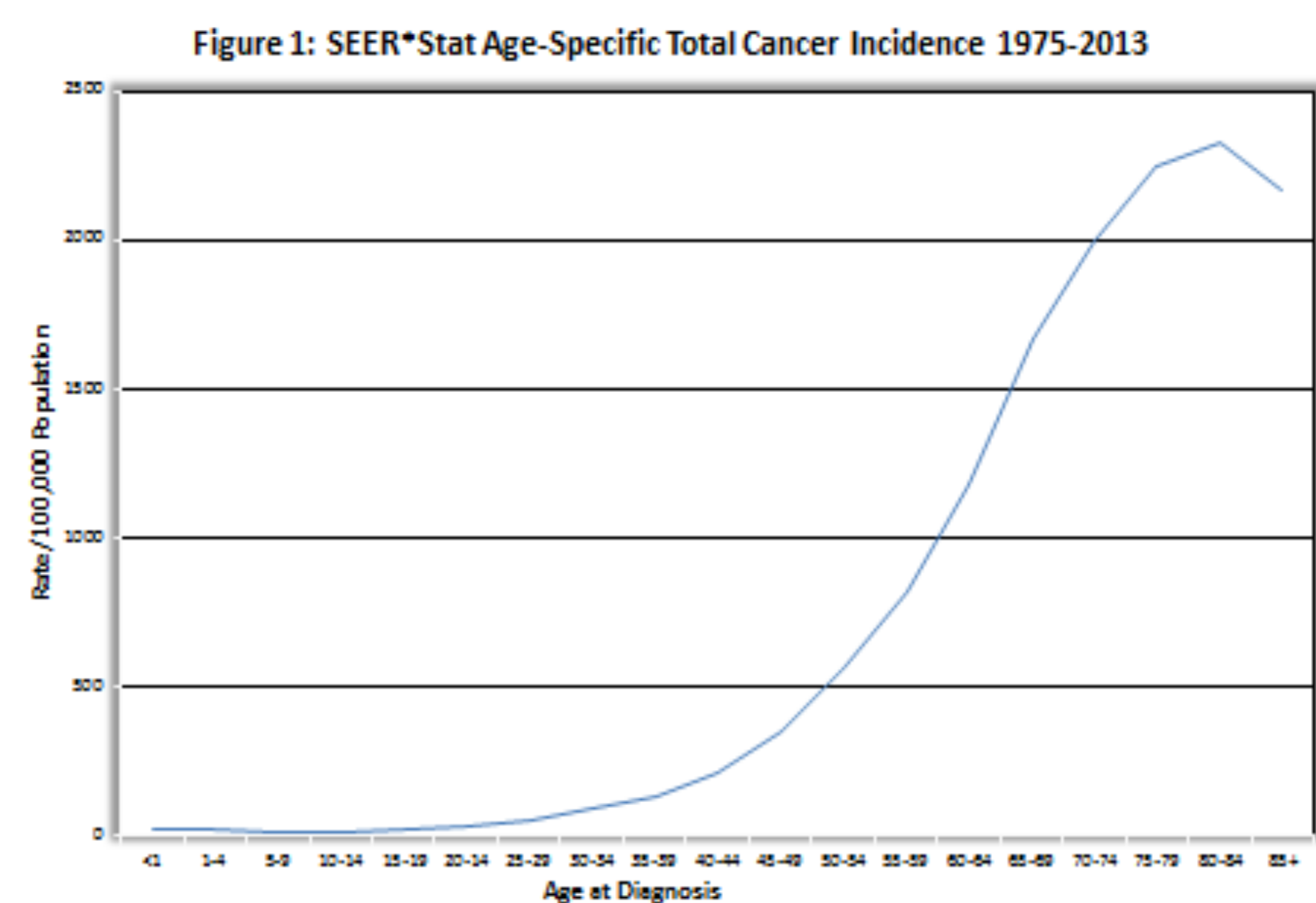
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## Introduction

One of the most commonly diagnosed illnesses in the elderly population is cancer. Despite research aimed at understanding the relationship between aging and cancer risk, the mechanisms are largely unknown. In order to explore the patterns in age-specific cancer incidence, we used a visualization approach. Tables and graphs of incidence statistics for each reported type of cancer, including all subtypes, were generated via SEER\*stat. Patterns were then compared to a general trend line of the total cancer incidence from the years 1975-2013, with a focus on incidence in the age group 85+ (Figure 1).

## Methods

Data from the Surveillance, Epidemiology, and End Results (SEER) program were used to calculate age-specific incidence rates by sex and race/ethnicity. SEER collects cancer incidence and survival data that cover approximately 30 percent of the US population. These data are available to researchers through the SEER\*Stat statistical software. As a general basis for comparison, the first graph (pictured below as Figure 1) was created using SEER\*Stat incidence data which were exported to Excel to show the incidence rates by age at diagnosis for all cancers in the SEER\*Stat registry. The same process was then repeated, keeping the age ranges the same, but stratifying by sex and race/ethnicity for each cancer and the corresponding subtypes. Graphs were visually reviewed to determine overall age-specific incidence patterns. After completing the graphs, each was categorized based on their curve pattern.



## Results

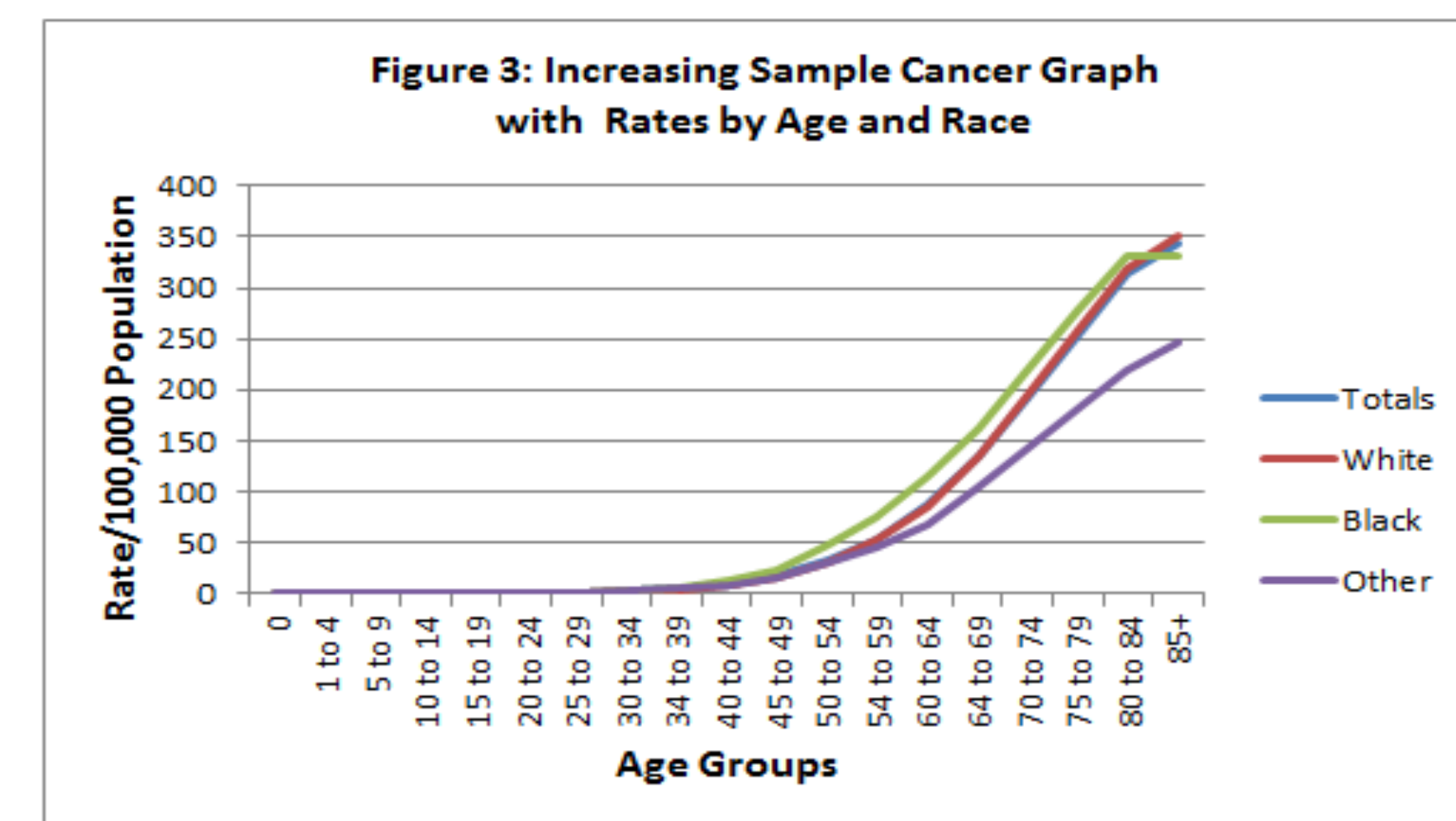
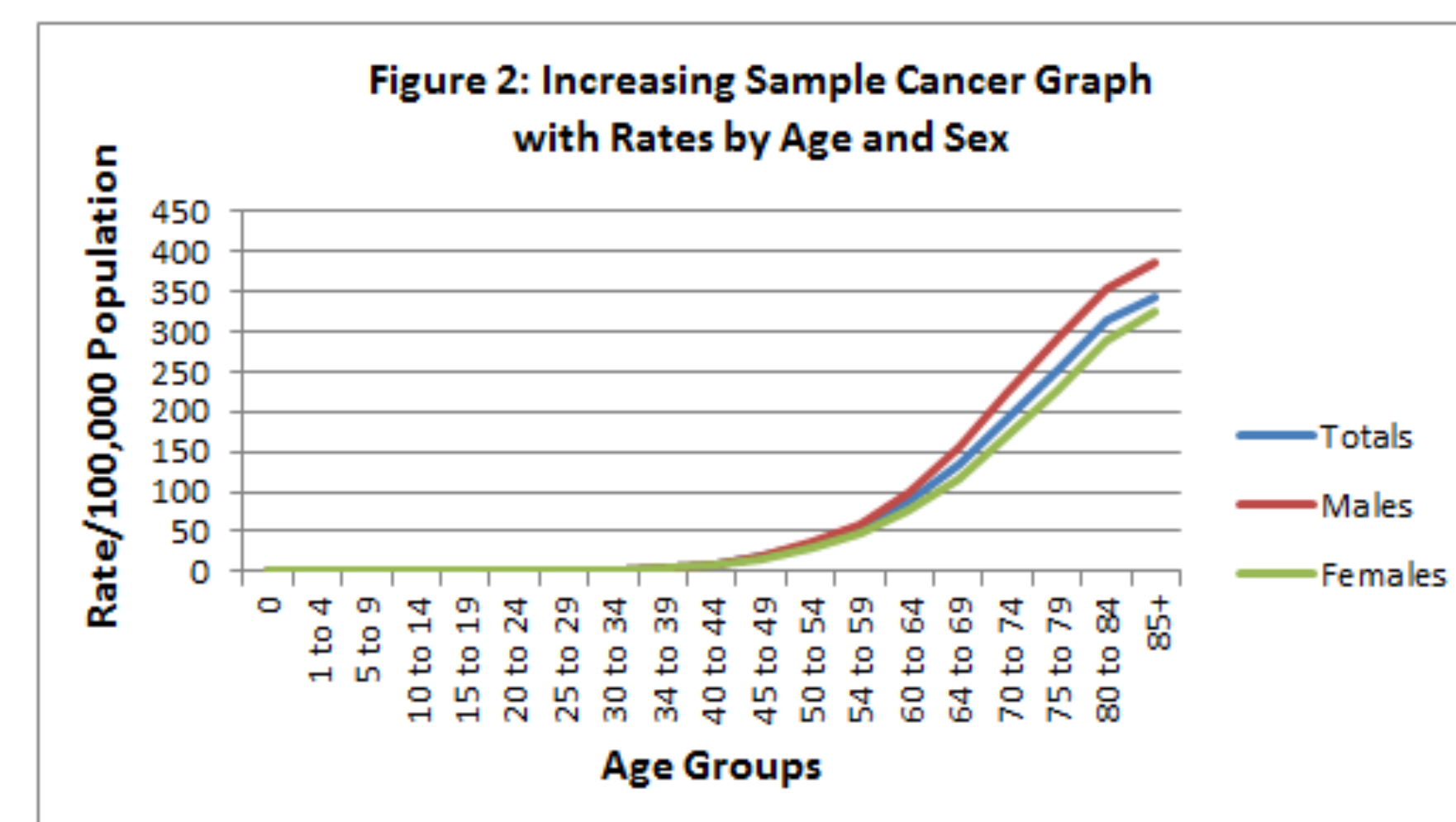
Results varied substantially by cancer type. We defined four patterns within the cancers: 1) an increasing trend with increasing age; 2) a decreasing trend in older ages; 3) a mixed pattern (some increasing, while others decrease within the same cancer type); and 4) a bimodal curve which included peaks in childhood/adolescence and in older age. Trends varied greatly depending on the type of cancer, the age at which the cancers were typically diagnosed, the sex of the individual, and the race/ethnicity of the individual (see Table 1). Age-specific patterns in African-American populations were particularly noteworthy and are presented separately.

Table 1: Distribution of Age-Related Cancers

Pattern	# of Cancers	% of Total
Increasing	44	45.8%
Decreasing	40	41.6%
Mixed	12	12.5%
Bimodal	9	0.09%

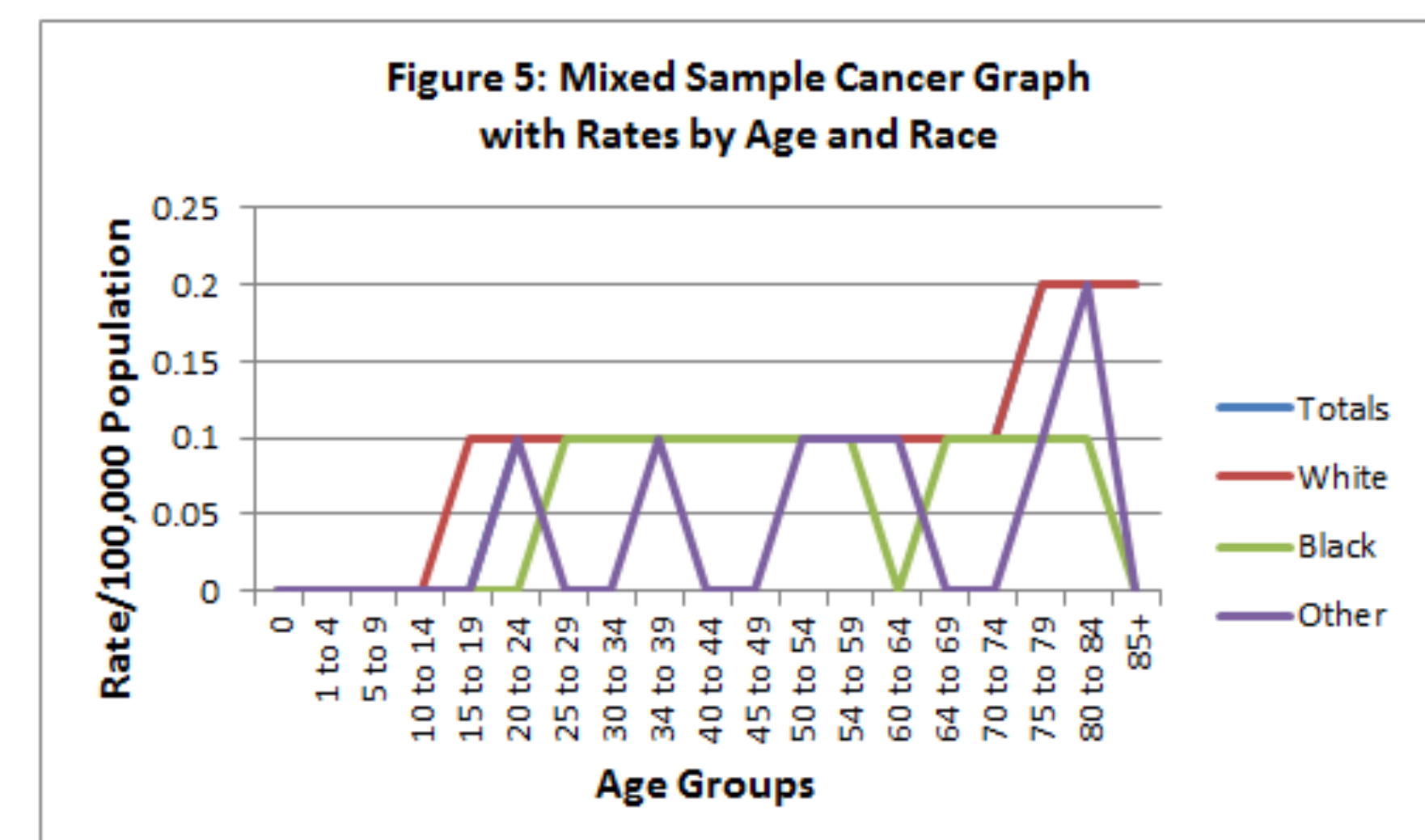
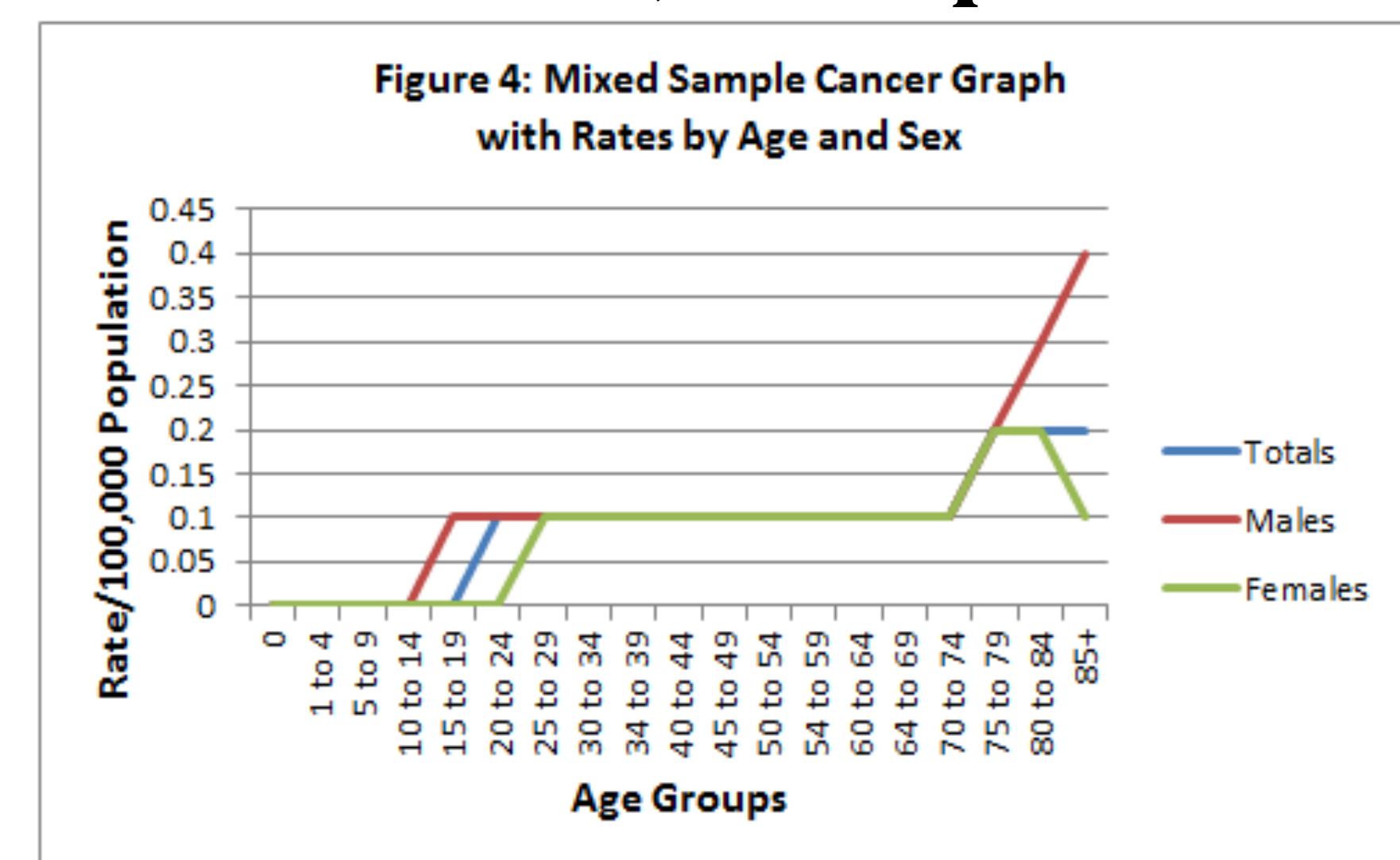
\*Note: Bimodal cancer number and percentage are not a portion of the total cancers used to calculate the percent of total because there are cancer types that fell under both mixed and bimodal distinctions. This resulted in an overall percentage greater than 100.

### Increasing Trend with Increasing Age



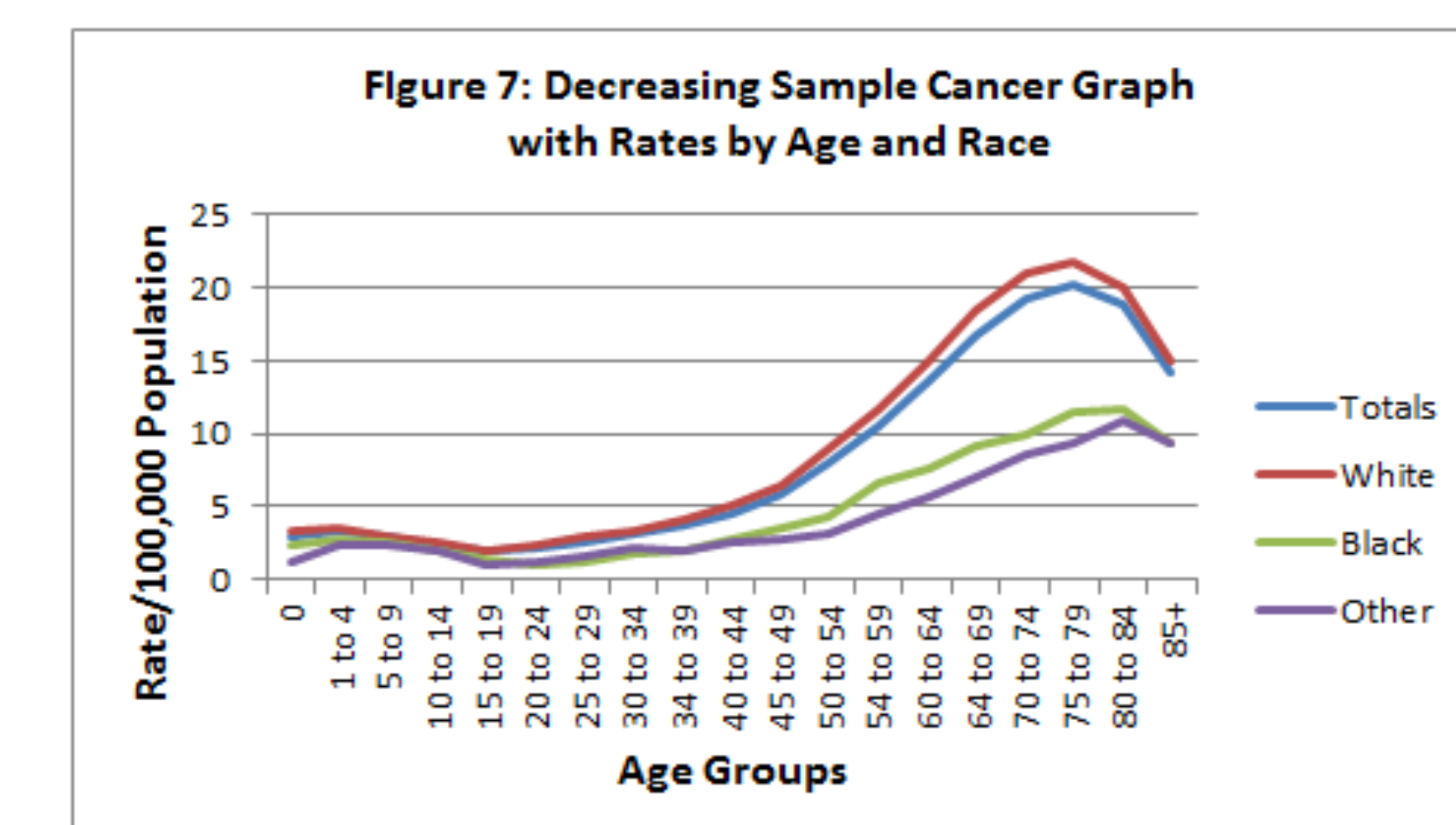
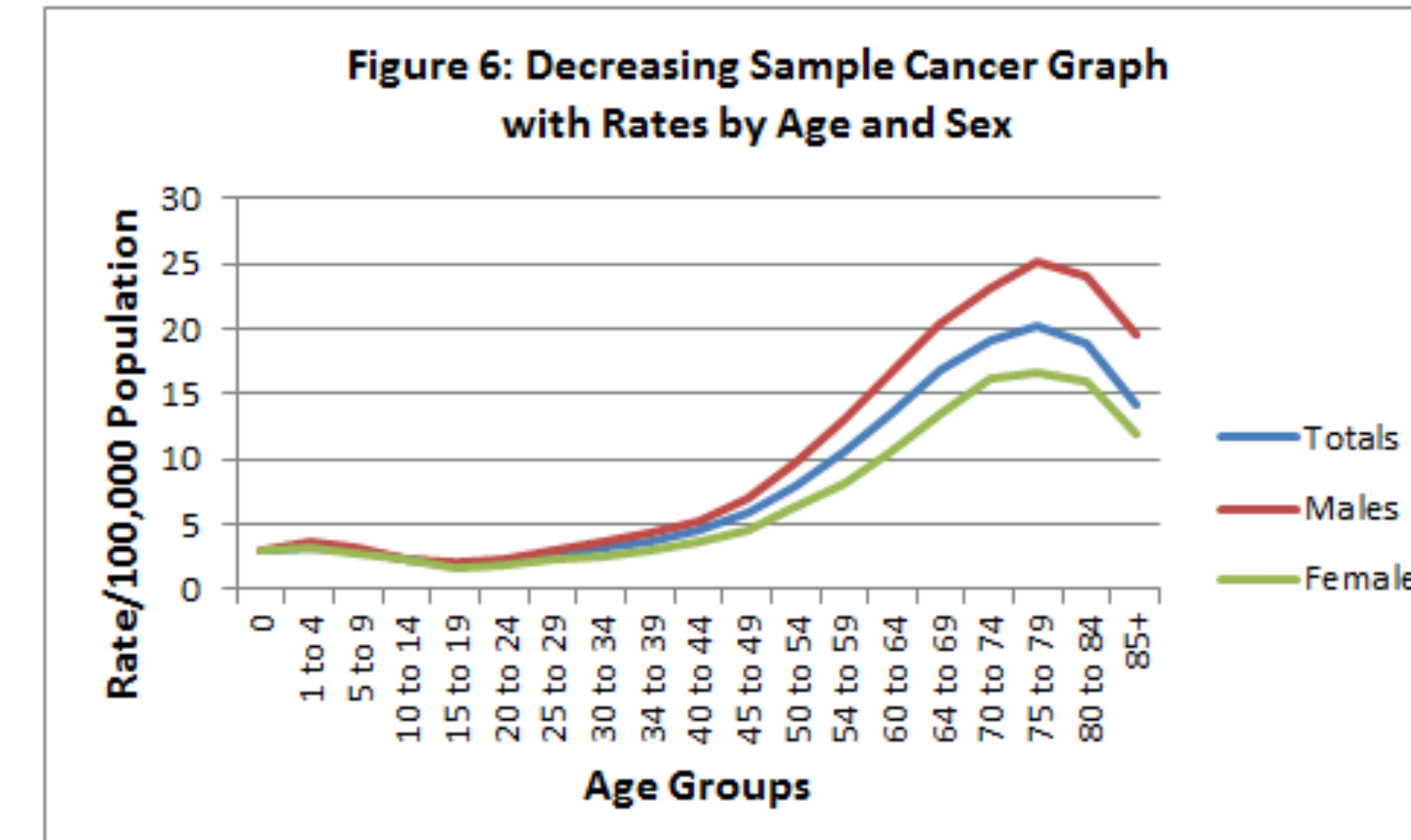
Cancer types that follow the patterns in Figures 2 and 3: Bones & Joints, Anus, Anal Canal, & Anorectum, Ascending Colon, Cecum, Colon & Rectum, Colon excluding Rectum, Gallbladder, Hepatic Flexure, Intrahepatic Bile Duct, Large Intestine, Other Biliary, Other Digestive Organs, Pancreas, Splenic Flexure, Stomach, Transverse Colon, Other Female Genital Organs, Uterus NOS, Vagina, Vulva, Soft Tissue including Heart, Acute Lymphocytic Leukemia, Acute Monocytic Leukemia, Acute Myeloid Leukemia, Aleukemic, Subleukemic, NOS, Chronic Lymphocytic Leukemia, Chronic Myeloid Leukemia, Leukemia, Lymphocytic Leukemia, Myeloid & Monocytic Leukemia, Other Acute Leukemia, Other Leukemia, Other Lymphocytic Leukemia, Other Myeloid/Monocytic Leukemia, Penis, Gum & Other Mouth, Lip, Salivary Gland, Nose, Nasal Cavity & Middle Ear, Melanoma of the Skin, Other Non-Epithelial Skin, Skin excluding Basal and Squamous, Other Urinary Organs, Urinary Bladder.

### Mixed Trend, Multiple Peaks



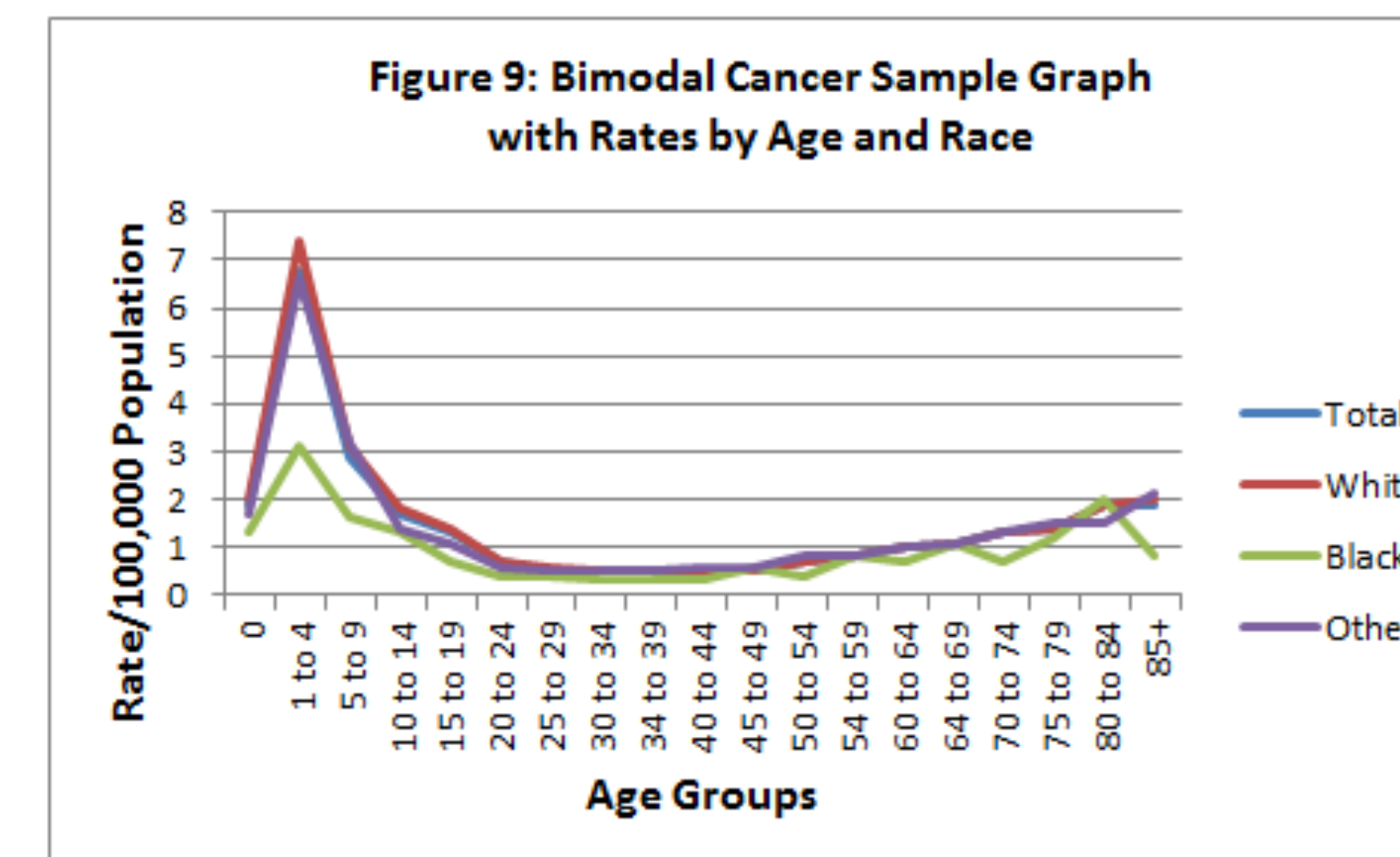
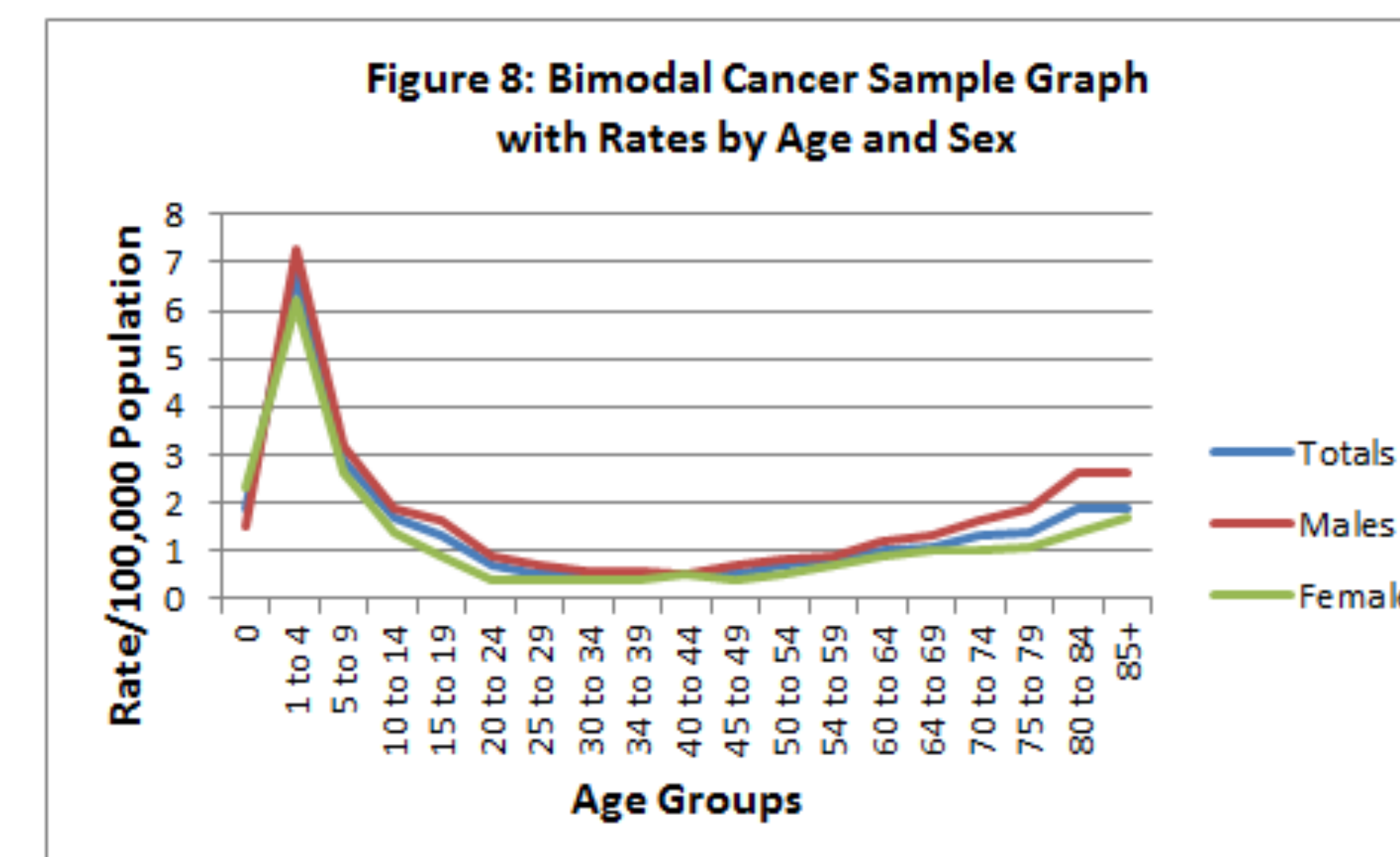
Cancer types that follow the patterns in Figures 4 and 5: Pleura, Trachea, Mediastinum & Other Respiratory Organs, Kaposi Sarcoma, Rectum, Ovary, Hodgkin-Extranodal, Lymphoma, NHL-Extranodal, NHL-Nodal, Non-Hodgkin Lymphoma, Other Male Genital Organs.

### Decreasing Trend in Older Ages



Cancer types that follow the patterns in Figures 6 and 7: Cranial Nerves Other Nervous System, Brain, Breast, Appendix, Descending Colon, Esophagus, Liver Intrahepatic & Bile Duct, Liver, Peritoneum, Omentum, Mesentery, Rectosigmoid Junction, Rectum & Rectosigmoid Junction, Retroperitoneum, Sigmoid Colon, Small Intestine, Myeloma, Endocrine System, Other Endocrine including Thymus, Thyroid, Eye & Orbit, Cervix Uteri, Corpus Uteri, Prostate, Testis, Mesothelioma, Floor of Mouth, Hypopharynx, Nasopharynx, Oropharynx, Other Oral Cavity and Pharynx, Tongue, Tonsil, Larynx, Lung & Bronchus, Kidney & Renal Pelvis, Ureter.

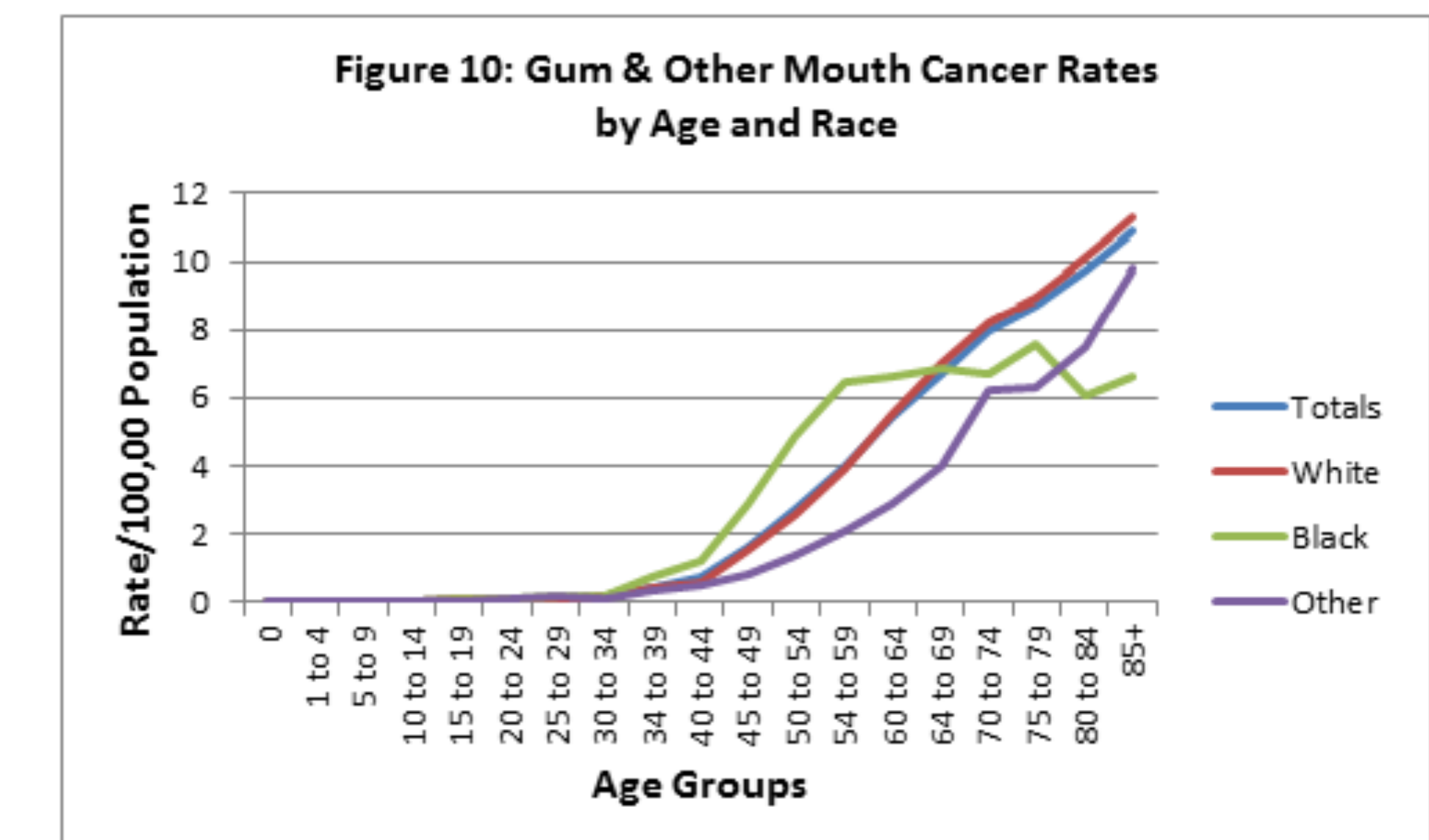
### Bimodal Curve



Cancer types that follow the patterns in Figures 8 and 9: Trachea, Mediastinum & Other Respiratory Organs, Retroperitoneum, Other Endocrine including Thymus, Eye & Orbit, Soft Tissue including Heart, Acute Lymphocytic Leukemia, Acute Monocytic Leukemia, Lymphocytic Leukemia.

### African-American Trends

Our results revealed that for some cancer types, the age-specific patterns among African-American populations were quite different from other race/ethnicity groups. Figure 10 is an example that shows the outstanding trend line for Blacks. Some of these specific trends increase with age, while others decrease with age.



Cancer types that follow the patterns (either increasing or decreasing) in Figure 10: Acute Lymphocytic Leukemia, Myeloma, Eye & Orbit, Cervix Uteri, Prostate, Mesothelioma, Tonsil, Hypopharynx, Larynx, Ureter, Vagina, Gum & Other Mouth, Lip, Salivary Gland, Other Non-Epithelial Skin, Skin excluding Basal and Squamous, Other Male Genital Organs.

## Conclusions

Overall, the dominant pattern seen was the increasing incidence with increasing age, followed closely by those cancers with a decreasing incidence in older ages. Some cancer types were consistent in their patterns for both sex and race/ethnicity, while other cancers had differing patterns, such as an increasing trend with an increasing age as well as a bimodal or decreasing trend in older ages for both sex and race/ethnicity. The same conclusion was drawn from the subtypes that fall into the general cancer types. Mixed trends and bimodal curves (adolescent cancers or double peaks) likely had more unstable incidence patterns because the numbers of cancers were significantly smaller than for more common cancer types (e.g. lip cancer vs lung cancer). Further research is required to determine what is causing the differing patterns in age-specific cancer.

## References

Surveillance, Epidemiology, and End Results (SEER) Program ([www.seer.cancer.gov](http://www.seer.cancer.gov))  
SEER\*Stat Database: Incidence - SEER 9 Regs Research Data, Nov 2015 Sub (1973-2013)  
<Katrina/Rita Population Adjustment> - Linked To County Attributes - Total U.S., 1969-2014  
Countries, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2016, based on the November 2015 submission.



Photo Source: <http://healthylivingafter60.com/tag/walking-for-seniors/>