Cancer in Los Angeles County:

Survival among Adolescents and Young Adults 1988-2014

USC/Norris Comprehensive Cancer Center

Keck School of Medicine
University of Southern California

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2017

Suggested citation:
Liu L, Hwang AE, Moke D, Tsai KY, Wojcik KY, Cockburn M, Deapen D (eds.). Cancer in Los Angeles County: Survival among Adolescents and Young Adults 1988-2014. Los Angeles Cancer Surveillance Program, University of Southern California, 2017.

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FOREWORD

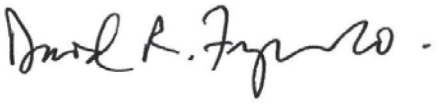
For years to come, *Cancer in Los Angeles County: Survival among Adolescents and Young Adults 1988-2014*, will undoubtedly serve as a polestar in the world of adolescent and young adult (AYA) cancer epidemiology. This monograph represents the second installment in a twopart exploration of incidence and survival trends among AYAs diagnosed with cancer in Los Angeles County. In reporting data from the demographically diverse population of Southern California, this extensive analysis both turns over new ground and establishes a benchmark for measuring AYA survival globally. Although some findings provide a degree of reassurance that the "war on cancer" is going reasonably well, others are—or ought to be—profoundly disturbing to us all.

This project addresses two broad questions in relation to AYA cancer: First, what proportion of AYAs is surviving after diagnosis with one of the 18 cancer types examined? Second, what impact do certain clinical, socioeconomic and demographic factors have on survival? As the reader will discover, the answers depend on where and how deep one looks. For example, these data confirm that survival after Hodgkin lymphoma, testicular cancer and thyroid cancer is largely very good. However, for some highly curable cancers like these, survival continues to fall years later, raising important questions about causes of late mortality. For other cancers such as stomach cancer, the survival probability remains dismal, illustrating the need for better therapies and earlier detection. For other cancers with intermediate survival, prognosis remains dependent on clinical stage, where access to care and education may be important factors to examine.

While serving as critically important benchmarks, some of these observations may not be altogether surprising to clinicians experienced in treating AYAs. The same cannot be said for the more detailed analyses. In non-Hodgkin lymphoma, men have dramatically lower survival than women. Within the AYA spectrum, age may be either a survival advantage or disadvantage, depending on the cancer. Sadly, for many cancers, startling relationships are apparent between survival, socioeconomic status and race/ethnicity. Taken together, these data generate urgent questions and new hypotheses in realms as diverse as cancer and host biology, environment, health services access and delivery, and cancer survivorship. Throughout it all, the need for cultural competency in both designing research and delivering cancer care and education has rarely appeared so compelling.

This project has drawn upon the outstanding faculty, staff and resources associated with the Los Angeles Cancer Surveillance Program, led by Dennis Deapen, DrPH, including the Keck School of Medicine of the University of Southern California (USC), the USC Norris Comprehensive Cancer Center, and Children's Hospital Los Angeles, among others. We have the distinct pleasure of working with this expanding group of talented and dedicated researchers that has coalesced around the unique scientific and clinical challenges posed in AYA oncology. It is noteworthy that whereas the first monograph, published only two years ago, was devoted to cancer incidence among AYAs in Los Angeles County and involved 14 contributors, this survival monograph benefits from 43. We congratulate all of them, and

especially Dr. Deapen and his co-editors, for successfully completing this substantial and much-needed analysis. Most of all, it is our sincere hope that the work represented herein will improve the lives of our AYA patients, their families, and our fellow citizens in this community of Los Angeles County we call home.



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EXECUTIVE SUMMARY

The Los Angeles Cancer Surveillance Program (CSP) serves as a resource to monitor trends and patterns of cancer incidence and survival. By monitoring trends, it identifies population subgroups at high risk of cancer and cancer related death, generates new hypotheses regarding cancer causes, and informs government officials and policymakers in determining funding for treatment and related social services. Examinations of population-based cancer survival patterns among adolescents and young adults (AYAs) 15-39 years of age by certain characteristics, such as sex, age, race/ethnicity, socioeconomic status (SES), and cancer stage* at diagnosis, provide a better understanding of the effectiveness of cancer treatments and help to identify subgroups of AYAs who are at greatest risk of cancer related death. Highlights of the survival differences found in this report include the following:

- AYA men have lower survival rates than AYA women for most of the cancers examined, except for a few (e.g., breast, colorectal, stomach cancers, and leukemia) that show no clear survival difference by sex.
- Younger AYAs have a survival advantage for some cancers (e.g., lung cancer, lymphomas), while for other cancers older AYAs have better survival (e.g., breast, colorectal, and stomach cancers).
- Compared to other racial/ethnic groups, black AYAs generally have the poorest survival rates for most cancer types, including cancers of lung, stomach, and testis.
- For many cancers (e.g., cervical, kidney) AYAs of higher SES have better survival, but for other cancers (e.g., stomach, uterus) SES does not make any difference in survival.
- AYAs diagnosed with early stage* cancers consistently have better survival than those diagnosed late, regardless of cancer type.

For the most common cancer types, survival patterns are summarized as follows:

- Breast cancer survival is worse for blacks, younger AYAs and those of low SES.
- Thyroid cancer has excellent survival overall, with only very minor survival differences. The only important prognostic factor appears to be stage* at diagnosis.
- Survival for testicular cancer is overall good with some differences by subtype. For seminoma testicular cancer, survival difference is only seen by SES, with those of lower SES having lower survival. For non seminoma testicular cancer, survival is lower in older AYAs, highest in non-Latino whites, and lowest in those of lower SES
- AYA men with melanoma have lower survival than women. Lower survival is also seen among blacks and low SES. Melanoma has the largest survival difference by stage*. Five-year survival rate is 96% for early stage* disease and 9% for distant stage* disease.

- Hodgkin lymphoma is typically a very curable cancer, although men, blacks, older AYAs, and those of low SES have lower survival.
- For non-Hodgkin lymphoma, men do dramatically worse than women. In addition, blacks, older AYAs, and those of low SES show worse survival.
- Kaposi Sarcoma survival has greatly improved after adequate treatment for HIV was introduced, however still remains lowest among blacks and those of low SES.
- Cervical cancer, now preventable with vaccination and screening, has lower survival among blacks, older AYAs and those of low SES.
- For brain and central nervous system cancers, survival is lower for men, older AYAs and those of low SES.

*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

The substantial differences among rates of most cancers among subgroups such as men and women and various race/ethnic groups provide clues for a better understanding of cancer.

PREFACE

Cancer is the leading cause of non-accidental death among adolescents and young adults (AYA) (ages 15- 39 years) in the United States (U.S.). Outcomes for children and older adults with cancer have improved greatly over the past three decades, however there has been little or no improvement in survival among AYA cancer patients. The reasons for this are not entirely understood and are likely multi-factorial, including differences in tumor biology, insurance coverage, clinical trial participation and adherence to treatment.

Understanding this unique population is a critical first step in developing effective clinical and research programs for AYA cancer patients and in targeting effective cancer control. High-quality cancer registries are central to those efforts. In each U.S. state, cancer registries identify newly diagnosed cancer patients and determine their survival experiences to track trends and create opportunities for research.

The Los Angeles Cancer Surveillance Program (CSP) is the population-based cancer registry for Los Angeles County, California. Since 1972, the CSP has collected and analyzed information on all new cancers diagnosed among residents of the County. Over the past 45 years, with the participation of physicians, hospitals and cancer patients, this information has produced major contributions to the knowledge and understanding of cancer: its causes, treatment, and effects on the lives of cancer patients and their families. Healthcare providers and researchers frequently use the information to help control cancer.

Leveraging the large and diverse population of Los Angeles County, the CSP has served as a resource for many epidemiological studies of cancer. This volume on AYA cancers provides physicians, researchers, public health officials and the public with high-quality data documenting the trends in survival of many different types of cancer among individuals 15 to 39 years of age in Los Angeles County over the past 27 years. These data illustrate considerable differences in cancer survival between men and women, among various racial/ethnic groups, and among varying socioeconomic groups in ways not previously available to our community. These differences not only identify the types of persons at greater and lesser risk of dying from each cancer, but also offer intriguing clues that may lead to better understanding of cancer, its prevention and its treatment.

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ACKNOWLEDGMENTS

The work by Dr. Moke and Dr. Wojcik on this project was supported respectively by training grants from the National Cancer Institute of the National Institutes of Health under contract T32CA09659 awarded to Children's Hospital Los Angeles and contract T32CA009492 awarded to the University of Southern California. The collection of cancer incidence data used in this study was supported by the California Department of Public Health pursuant to California Health and Safety Code Section 103885; Centers for Disease Control and Prevention's National Program of Cancer Registries, under cooperative agreement 5NU58DP003862-04/DP003862; the National Cancer Institute's Surveillance, Epidemiology and End Results Program under contract HHSN261201000140C awarded to the Cancer Prevention Institute of California, contract HHSN261201000035C awarded to the University of Southern California, and contract HHSN261201000034C awarded to the Public Health Institute. The ideas and opinions expressed herein are those of the author(s) and do not necessarily reflect the opinions of the State of California, Department of Public Health, the National Cancer Institute, and the Centers for Disease Control and Prevention or their Contractors and Subcontractors. This work would not be possible without the work and dedication of CSP field technicians, other CSP staff members, and cancer registrars across Los Angeles County and beyond.

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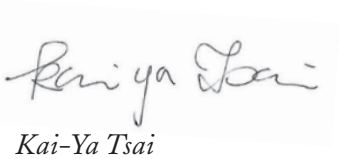

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INTRODUCTION

ADOLESCENT AND YOUNG ADULT (AYA) CANCERS

Approximately 87,000 AYAs are newly diagnosed with cancer in the U.S. each year, seven times more than the number diagnosed under the age of 15. In Los Angeles County, about 2,600 AYAs are diagnosed with cancer each year.

Incidence rates of AYA cancers vary by race and ethnicity. In general, cancer incidence rates are highest among non-Latino whites. Blacks and Latino whites have intermediate rates and Asians/Pacific Islanders have relatively low rates.

The distribution of cancer types in AYAs differs dramatically by sex and age and changes over the span of ages from 15 to 39 years. For example, testicular cancer, leukemia, and lymphoma are the most common cancer types in younger men 15 to 24 years. Among older AYA women 25 to 39 years, breast, thyroid, and cervical cancers are the more common cancer types.

Our understanding of the biology and causes of AYA cancers is limited. For example, it is unknown why among AYAs incidence rates for breast cancer are higher for black women than white women, when the reverse is true for women 40 years and older. Furthermore, it is unclear why AYA women with breast cancer are diagnosed with more aggressive disease than older women.

The AYA population also has unique challenges and personal needs due to their rapidly-changing life roles including establishing and maintaining independence, developing their personal identity, setting education and employment goals, and creating personal relationships including family planning.

Despite major improvements in survival for children and older adults with cancer over the past three decades, there has been little or no improvement in survival among AYA cancer patients. While the reasons for this disparity are not completely understood, factors that may contribute to the lack of improvement for AYA patients include: differences in tumor biology, insurance coverage, compliance with recommended treatment, and access to health care. AYA patients are more likely to experience a delay in diagnosis and are less likely to be referred to comprehensive cancer centers than other age groups. Furthermore, AYAs have one of the lowest rates of cancer clinical trial participation, only second to the very elderly.

Due to the unique needs of the AYA population, cancer centers are developing special AYA units and programs, designed to facilitate and support AYA research, improve clinical trial enrollment, train medical professionals in the care of AYA patients, and provide age-appropriate support services for AYA patients.

HISTORICAL BACKGROUND OF THE CSP

The Los Angeles Cancer Surveillance Program (CSP) is the population-based cancer registry for Los Angeles County. It identifies and obtains information on all new cancer diagnoses made in the County. The CSP was organized in 1970 and operates within the administrative structure of the Keck School of Medicine and the Norris Comprehensive Cancer Center of the University of Southern California. In 1987, it became the regional registry for Los Angeles County for the then new California Cancer Registry. The CSP is one of 10 such regional registries collectively providing statewide coverage. In September of 1992, the CSP joined the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER)

program. This consortium of 18 population-based SEER registries provides the federal government with ongoing surveillance of cancer incidence and survival in the U.S. To date, the CSP database contains more than 1.7 million records, and about 41,000 incident cancers are added annually. The CSP is one of the most productive cancer registries in the world, in terms of scientific contributions toward understanding the demographic patterns and the causes of specific cancers. The CSP has a bibliography of more than 6,800 publications in scientific journals. The registry supports a large ongoing body of research funded mainly by the U.S. National Cancer Institute, other cancer research organizations, and the State of California.

THE DIVERSE POPULATION OF LOS ANGELES COUNTY

Los Angeles County is the most racially/ethnically diverse county in the U.S. The number of residents living in Los Angeles County exceeds 10 million, according to the 2015 population estimates. Hispanic or Latino individuals account for 48.2% of the County's total population, in contrast to 38.4% in California and 17.1% in the U.S.[1] The proportion of non-Latino whites in Los Angeles County is 26.9%, as compared to 38.7% in California and 62.3% in the U.S.[1] About 8.9% of U.S. Latinos, 8.7% of U.S. Asian Americans, and 5.0% of U.S. Pacific Islanders live in Los Angeles County.[1] People of multi-race count for 3.9% of the County's total population, much higher than the national average of 3.0%.[1]

The 1.4 million Asian Americans in Los Angeles County include 0.4 million Chinese, 0.3 million Filipino, 0.2 million Korean, 0.1 million Japanese, over 92,000 Vietnamese, and over 83,000 Asian Indian.[1] Los Angeles County is also home to more than 27,000 Native Hawaiians and Other Pacific Islanders.[1]

Among the 4.8 million self-reported Hispanics or Latinos in the County, 76.3% identify as Mexican, 8.6% Salvadoran, 5.4% Guatemalan, 1.0% Puerto Rican, 0.8% Cuban, 1.0% Honduran, 0.9% Nicaraguan, and 2.7% South American.[1] A higher proportion (40.1%) of Latinos in Los Angeles County identify themselves as "some other" race than in the U.S. as a whole (26.2%).[1]

About 3.5 million Los Angeles County residents are foreign-born; 28.5% of them entered the country since 2000.[1] More than half (56.8%) of the total population five years of age or older speak a language other than English.[1]

The 2.7 million non-Latino white population also has highly diverse origins. The population of European origin includes large numbers of persons from Britain, Germany, Ireland, Italy, Russia, France, and other parts of Europe. In the past 30 years the County experienced a substantial influx of immigrants from Iran, Lebanon and the former Soviet Union. The Armenian community is estimated to be nearly 200,000. Over 78,000 individuals of Arabic descent live in Los Angeles County.[1]

Every numerically important religious group in the U.S. is represented by sizeable populations. There is also a wide variation in socioeconomic and sociocultural characteristics of the County population. Occupation and industry data reflect the diversity one would expect of a large urban metropolis. In addition, Los Angeles County is characterized by geographic diversity, with regions of mountains, valleys, deserts, and seashores.

With its large and diverse populations, Los Angeles County is an ideal place for monitoring disease

occurrence and conducting epidemiologic investigations. The AYA population in Los Angeles County is currently estimated to be more than 3.7 million.[1]

HOW CANCER IS REGISTERED

Under the California model of reporting, a passive cancer surveillance system has been implemented statewide, in which hospitals and other facilities where cancer is diagnosed or treated bear the responsibility for identifying and reporting cancer cases to the local registry within six months after the patient's diagnosis or treatment. To provide complete demographic and treatment information on each new cancer occurring among the residents of Los Angeles County, and to guarantee compliance with reporting requirements, the CSP combines elements of an active and a passive surveillance system. For active surveillance, each of the medical facilities in which microscopic verification of cancer occurs is monitored by a CSP field technician who systematically screens all hematology and pathology reports to identify all previously unreported cancer diagnoses. The State-mandated passive surveillance system requires each hospital or other reporting facility to complete a full report known as an abstract, including stage and treatment information, on every cancer case seen at the facility. All completed abstracts are linked by the CSP to the pathology reports obtained under active surveillance to assure that one abstract is completed for each histologically-verified cancer diagnosis. In addition, any previously unrecognized cancer diagnoses among Los Angeles County residents, identified as a result of searching computerized death records, are traced back to patient records in hospitals or other facilities so that data can be abstracted, when possible, in a similar way to data found using pathology reports.

USE OF CSP DATA FOR RESEARCH

The CSP data serve as a descriptive epidemiological resource to generate new hypotheses regarding specific cancer sites or histologic subtypes, monitor descriptive trends and patterns of cancer incidence, and identify demographic subgroups at high risk of cancer. A high priority is always placed on exploring demographic patterns and trends in cancer incidence among the racially and ethnically diverse population of Los Angeles County.

THE IMPORTANCE OF INVESTIGATING TIME TRENDS AND SURVIVAL

To keep an eye on cancer rates

Monitoring cancer rates provides clues about what causes cancer. When we observe a change in the rate of cancer that seems to follow a change in an environmental exposure, we consider the possibility of a link between the exposure and cancer. For example, at the beginning of last century, increasing lung cancer rates followed the introduction and increasing popularity of cigarettes and smoking.

To monitor improvements in cancer outcomes

While cancer prevention is our ultimate goal, efforts are also focused on successful treatment. An ultimate measure of treatment success is long-term survival, especially in the AYA age group with many more years of life expectancy. We seek to identify the factors associated with long-term survival to benefit future cancer patients.

To know whether cancer control efforts are working

We also monitor cancer rates to provide a "report card" on how well cancer prevention programs work. We generally expect that a successful intervention program, such as the introduction of the HPV (human papillomavirus) vaccine should be followed by a decline in cervical and other HPV-related cancer rates.

To decide what resources are required to fight cancer

Because cancer is such an important health problem and is costly in terms of treatment and social costs, such as loss of work time and quality of life, it is important to have a clear idea of the changing burden of cancer on society. Government officials and policymakers use trends in cancer rates to determine funding for screening, treatment and related social services, as well as to establish priorities for supporting effective research into the causes and prevention of cancer and the development of treatments.

To see the effect of changes in cancer screening and detection methods

Many things can cause changes in cancer rates, including changes in the distribution of the factors that cause the disease, changes in our ability to prevent or detect cancer early, changes in the population, changes in diagnostic criteria to define a type of cancer, and even simple random variation.

To make cancer a disease of the past

Keeping an eye on cancer rates provides clues about the causes of cancer, how successful we are at preventing cancer, and where we should focus our efforts in the future to make cancer a disease of the past.

PROTECTION OF CONFIDENTIALITY

Confidentiality procedures at the CSP are rigidly formulated and maintained. All employees of the CSP sign a confidentiality pledge after being advised of the necessity for maintaining strict confidentiality of patient information, and are shown methods to assure this. Any records containing identifying information are transported to the CSP in locked carrying cases and are stored in locked filing cabinets at the CSP. Confidentiality of computerized data is assured by highly restricted access. All reports and summaries produced for distribution by the CSP, such as those presented here, are in statistical form without any personal identifiers. All individual studies using confidential information obtained from the registry are individually reviewed by the USC Institutional Review (Human Subjects) Board, as is the registry itself, on a regular basis. For studies from outside investigators, review and approval by a federally approved institutional review board is required.

REFERENCE

1. U.S. Census Bureau, 2011-2015 American Community Survey 5-Year Estimates.

Keeping an eye on cancer rates provides clues about the causes of cancer, how successful we are at preventing cancer, and where we should focus our efforts in the future to make cancer a disease of the past.

MATERIALS AND METHODS

CANCER DATA

Cancer data used in this report are based on new cancer cases diagnosed among the AYA residents between the ages of 15 to 39 years old in Los Angeles County from January 1, 1988 to December 31, 2014, and reported to the CSP by February 28, 2017. A total of 71,225 new AYA cancers diagnosed during this time period are identified. Follow-up is complete through December 31, 2014.

Because cancer survival can be affected by both patient and tumor characteristics, evaluation of survival needs to consider these factors. We group the AYA cancer patients by sex (male, female), age (15-24, 25- 34, 35-39), race/ethnicity (non-Latino white, black, Latino white, Asian/Pacific Islander, other), socioeconomic status (SES) (high, mid-high, middle, mid-low, low), and stage of disease at diagnosis (localized, regional, distant). Early stage refers to cancer that has not spread from original location (localized). Late stage refers to cancer that has spread beyond original location to either nearby organs/ lymph nodes (regional), or other parts of the body (distant). We describe in more detail how race/ethnicity, SES, and stage are defined in Appendix A.

Given tumors affecting AYA individuals often differ from those affecting children and older adults,[1] we used the SEER AYA Site Recode system (see Appendix C) developed by the Surveillance Epidemiology and End Results (SEER) Program of the National Cancer Institute (NCI), based on the classification scheme proposed by RD Barr and colleagues,[2] to classify the AYA cancer types. We further separate or re-group a couple of AYA Site Recode categories that either combine distinctively different cancer types (e.g., cervical and uterine) or split cancer of the same organ into different cell types (e.g., testicular and ovarian). A summary of cancer site definitions used in this report is provided in Appendix C.

Cancers are distinguished by tumor behavior, whether they are *invasive* (those that have invaded into surrounding tissues) or *in situ* (early cancer that has not invaded surrounding tissues). In this report we follow the SEER AYA Site Recode to include only invasive cancers for all cancer groups, except for brain and central nervous system that includes all tumor behaviors.

The follow-up of cancer patients is conducted by the CSP through a combination of methods including information sharing from the reporting hospitals, record linkage with vital statistics, Social Security Administration, driver license information, and credit records. The follow-up information helps to determine the vital status of a cancer patient, calculate the survival time, and estimate the survival rate of the specific cancer.

Of the 71,225 AYA cancer cases diagnosed among residents in Los Angeles County during 1988-2014, 56,851 (80%) are distributed across 18 major cancer sites, for which we present the survival analysis in this report. The remaining 14,374 (20%) are mostly classified as small, miscellaneous, or unspecified cancers, including 158 with missing information of last follow-up dates. These cases are excluded from the site-specific survival analysis, but included in the total AYA cancer counts and incidence rate calculations.

STATISTICAL METHODS

Observed survival is the actual percentage of patients still alive at some specified time after the diagnosis of cancer. It considers deaths from all causes, cancer or otherwise. Using non-parametric Kaplan-Meier survival function, we calculated the observed survival at 1-, 3-, and 5-year marks after diagnosis by cancer type and stratified by sex, age, race/ethnicity, SES, and tumor stage. Graphs of the estimates of the survival rate allow us to see how the survival probability changes with survival time and differs by patient and tumor characteristics.

We also provide case count and percentage distribution of cancer cases by cancer type within each specific racial/ethnic population to show the cancer profile by population group. In order to compare cancer risk levels among different groups or across different cancer types, we calculate and present the age-adjusted incidence rate by considering the number of cancer occurrences in relation to the size of the group's at-risk population.

CAUTIONS IN INTERPRETATION

Cancer data in this report are based on new primary cancer cases during 1988-2014 and reported to the CSP as of February 28, 2017. While at least 95 percent of estimated new cases has to be reported to the CSP before a incidence year can be considered as complete, a small number of additional cases may continue to be reported for 2014 and earlier years as time goes by. This may have a minor effect on the cancer survival and risk estimates for this report period.

As with all population-based cancer registries, the CSP does not directly contact patients for follow-up. The quality of follow-up information is critical to the survival evaluation. The accuracy of a patient's racial/ethnic classification depends on the patient's racial/ethnic identification recorded in the medical charts. This information may be based on self-identification by the patient, on assumptions made by an admission clerk or other medical personnel, or on an inference made using race/ethnicity of parents, birthplace, maiden name or last name. Efforts that evaluate the data quality of population-based cancer registries have concluded that misclassification of race/ethnicity may exist for a very small portion of the registry records. The reliability of estimates for at-risk population may affect the cancer risk estimates.

Finally, special caution should be used when interpreting the meaning of the analyses that are based on only a few cases. Calculations based on small numbers are statistically unstable. For that reason and for protecting patient confidentiality, we adopted a suppression rule of withholding any case count that is less than 10 in the tables and any estimates based on such small numbers. No suppression was made in graphs for better visualization.

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2. Barr RD, Holowaty EJ, Birch JM. Classification schemes for tumors diagnosed in adolescents and young adults. Cancer 2006; 106: 1425-1430.

OVERVIEW OF AYA CANCER IN LOS ANGELES COUNTY

While this monograph primarily describes cancer survival rates in the AYA population in Los Angeles County, it is helpful to begin with an understanding about the disparities in cancer type distributions and risk levels among the different groups of AYAs. Different types of cancer are very different diseases, each with its own occurrence patterns, distinct treatments and survival outcomes. In this section, we provide an overview of the overall cancer cases diagnosed among AYAs in Los Angeles County during 1988-2014 by demographic and tumor characteristics, overall AYA cancer risk comparisons by race/ethnicity and sex, as well as cancer-specific risk levels by age group and sex. Then, we present the 5-year survival rates by cancer type, race/ethnicity, and sex.

TOTAL NUMBER OF AYA CANCER CASES BY RACE/ETHNICITY

During 1988-2014, a total of 71,225 cancers were diagnosed among the 3.7 million AYA residents 15-39 years old in Los Angeles County. Of those, 28,697 (40%) are non-Latino white, 26,905 (38%) Latino white, 6,495 (9%) Asian/Pacific Islander, and 6,310 (9%) black.

TOTAL NUMBER OF CANCER CASES DIAGNOSED IN AYAS BY RACE/ETHNICITY, SEX, AGE GROUP, SOCIOECONOMIC STATUS, AND STAGE*, LOS ANGELES COUNTY, 1988-2014

Race/Ethnicity	Total	Sex			Age Group			Socioeconomic Status						Stage*			
		Male	Female	Other	15-24	25-34	35-39	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Asian/Pacific Islander	6,495	2,070	4,425	–	851	2,691	2,953	1,463	1,568	1,563	1,183	670	48	2,899	1,681	1,270	409
Black	6,310	2,379	3,930	<10	855	2,657	2,798	511	966	1,239	1,869	1,675	50	2,493	1,386	1,502	629
Latino White	26,905	11,144	15,743	18	5,265	12,208	9,432	1,459	3,270	5,359	7,673	9,001	143	11,822	6,074	6,087	2,021
Non-Latino White	28,697	13,109	15,583	<10	3,629	12,965	12,103	9,558	8,757	5,731	3,226	1,184	241	13,720	5,453	4,742	2,226
Other	2,818	1,171	1,647	–	430	1,332	1,056	750	650	507	368	176	367	1,294	304	228	402
Total	71,225	29,873	41,328	24	11,030	31,853	28,342	13,741	15,211	14,399	14,319	12,706	849	32,228	14,898	13,829	5,687

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

By Sex

Overall, there are more women than men among AYA cancer patients (41,328 vs. 29,873). This overall pattern of predominance in women remains true in all racial/ethnic groups and is largely because of the high numbers of sex specific cancers of breast, cervix, ovary, and uterus.

By Age

Regardless of race/ethnicity, the number of AYA cancer cases increases with age, with the younger AYAs having fewer cancer diagnoses than older AYAs.

By Socioeconomic Status

In non-Latino whites and Asians/Pacific Islanders, more AYA cancer patients are of higher socioeconomic status (SES), while more blacks and Latino whites are of lower SES.

By Stage Of Disease At Diagnosis

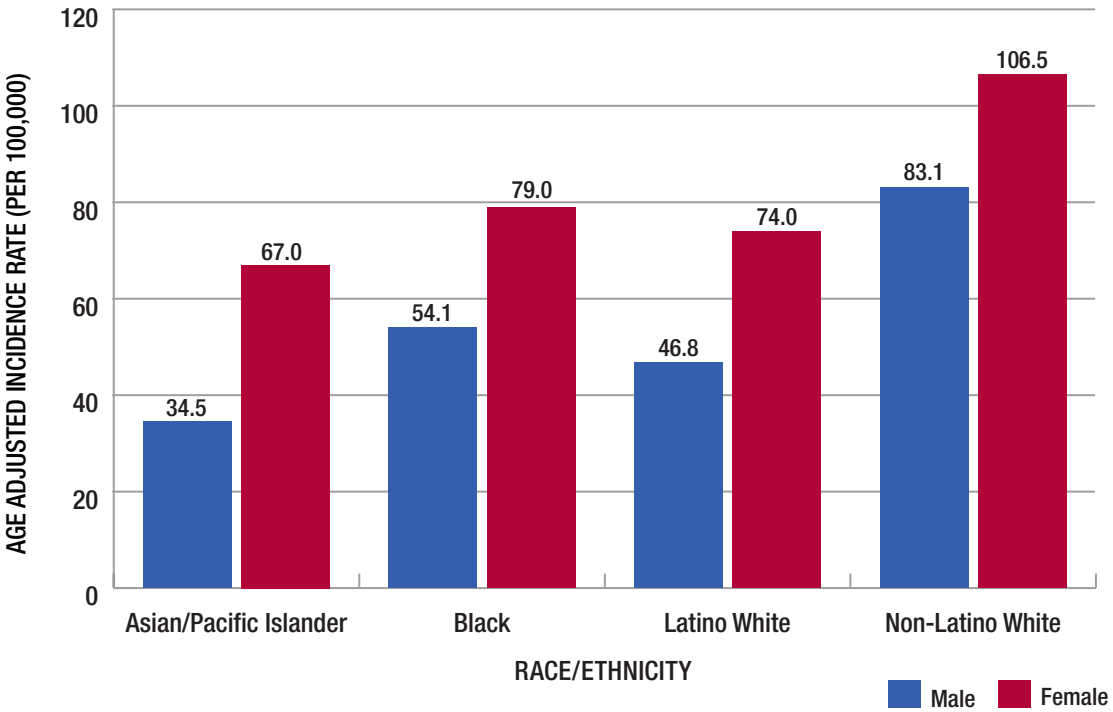
In total as well as by race/ethnicity, a higher number of patients are diagnosed at the localized stage than either regional or distant stages. Localized stage is an early stage indicating the cancer has not spread from its original location, while regional and distant stages suggest the cancer has spread beyond the original location to regional lymph nodes or further systemically. Early diagnosis of cancer usually means better survival outcomes.

INCIDENCE RATES OF AYA CANCERS

By Sex And Race/Ethnicity

The age-adjusted (2000 US standard) AYA cancer incidence rates of all cancer types combined show obvious disparities by sex and race/ethnicity. Across all racial/ethnic groups, AYA women have higher risk of developing cancers than AYA men. In men or in women, non-Latino white AYAs have the highest cancer rate, followed by black, Latino white, and Asian/Pacific Islander AYAs.

AGE-ADJUSTED INCIDENCE RATES FOR ALL AYA CANCERS COMBINED BY RACE/ETHNICITY AND SEX, LOS ANGELES COUNTY, 1988-2014

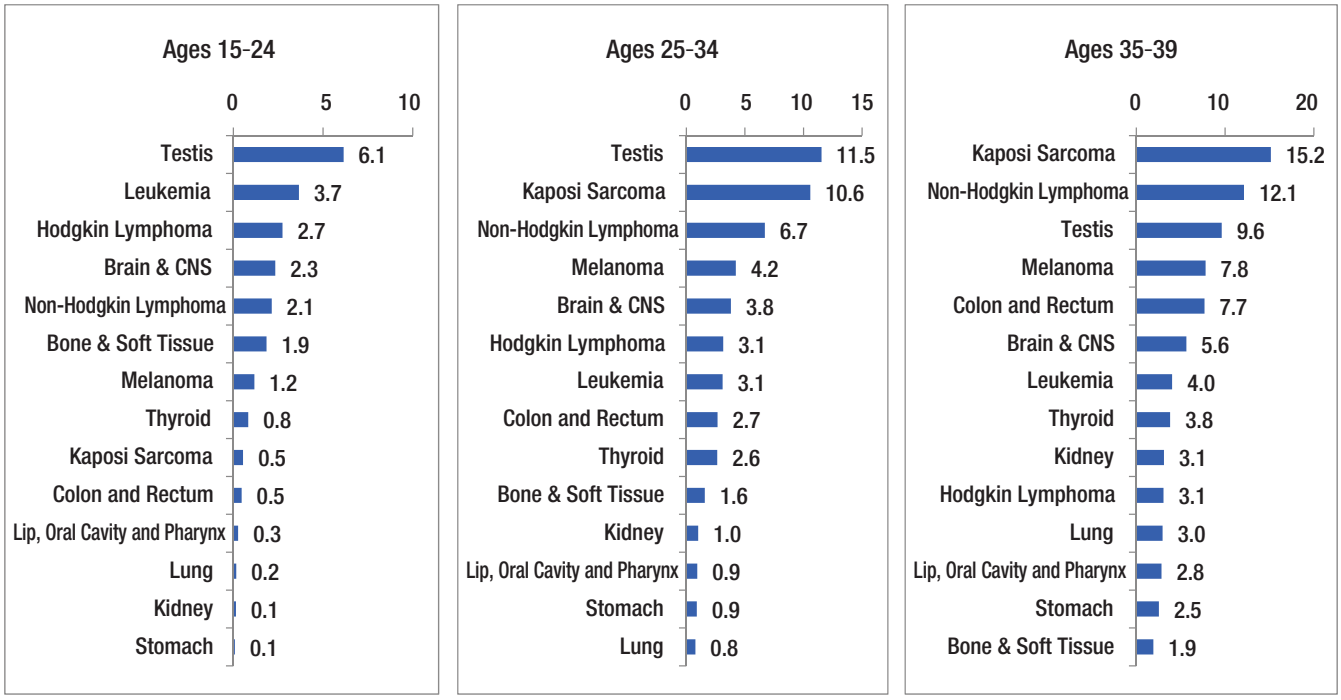


By Cancer Type And Age Group

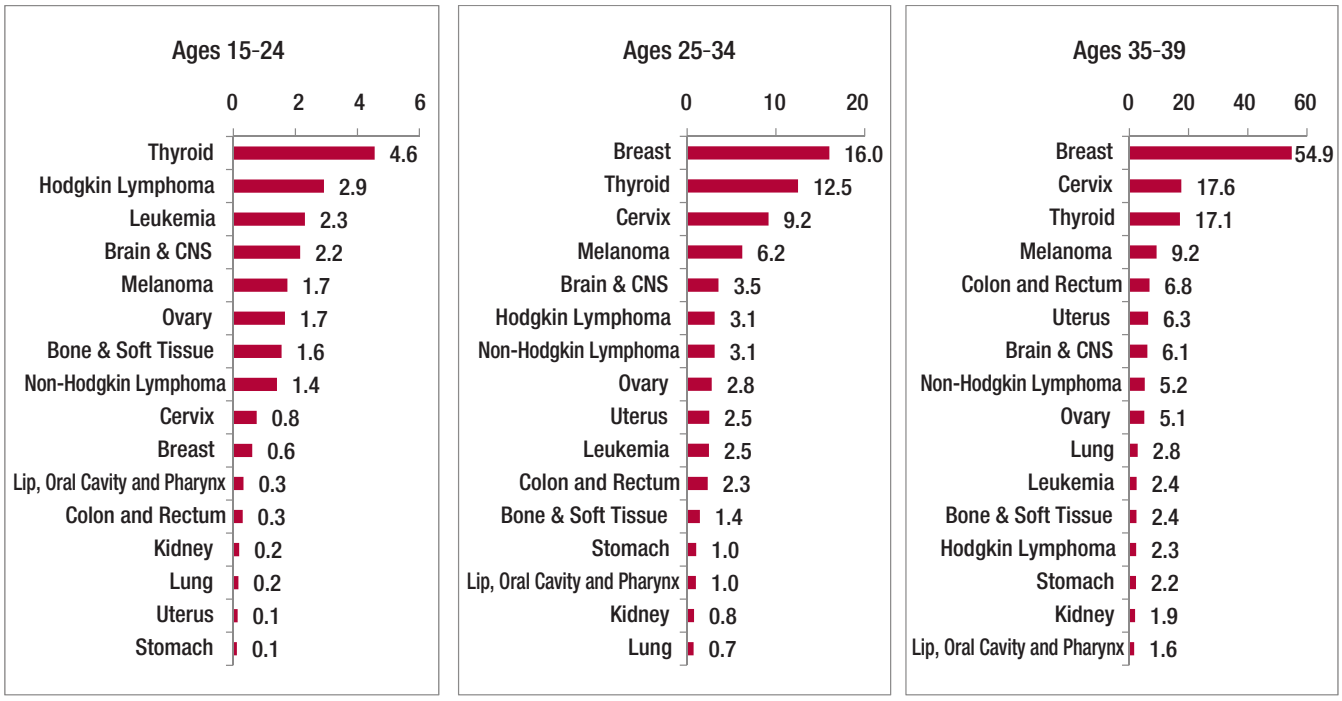
Cancer risk differs not only by sex and race/ethnicity, but also by cancer type and age group. The following graphs illustrate the cancer-specific incidence rates by age group in AYA men and women respectively. Testicular cancer ranks as the most common cancer in AYA men under age 35, but the third most common in ages 35-39. Breast cancer is the most common for AYA women 25-39 years old, but the tenth for younger women 15-24 years old.

AGE-ADJUSTED INCIDENCE RATES (PER 100,000) AMONG AYAS BY CANCER TYPE, SEX, AND AGE GROUP, LOS ANGELES COUNTY, 1988-2014

Males



Females



CANCER-SPECIFIC 5-YEAR SURVIVAL RATES

Detailed information about the survival probabilities of each cancer type by year after diagnosis will be presented in the following cancer-specific chapters. The following table summarizes the 5-year survival rates by cancer type, race/ethnicity, and sex among AYAs in Los Angeles County during 1988-2014. They are the observed proportions of AYA cancer patients who are still alive at 5 years after their cancer diagnoses (5-year survival). The lower the 5-year survival rate, the higher the mortality. Of note, these 5-year survival rates, as well as other survival statistics presented in this report, are based on all-cause deaths, not limited to cancer deaths.

It is informative to compare the survival differences across cancer types and racial/ethnic groups, and between men and women. Regardless of race/ethnicity and in both men and women, thyroid cancer has the highest 5-year survival rate, nearly 100%, while stomach cancer has the lowest, about 20%. Generally speaking, survival at five years after diagnosis is better in women than in men in each cancer type except for breast, stomach, and leukemia. This survival advantage in women is most pronounced in non-Hodgkin lymphoma (74.5% vs. 45.5%).

FIVE-YEAR SURVIVAL RATES AMONG AYAS BY CANCER TYPE, RACE/ETHNICITY, AND SEX, LOS ANGELES COUNTY, 1988-2014

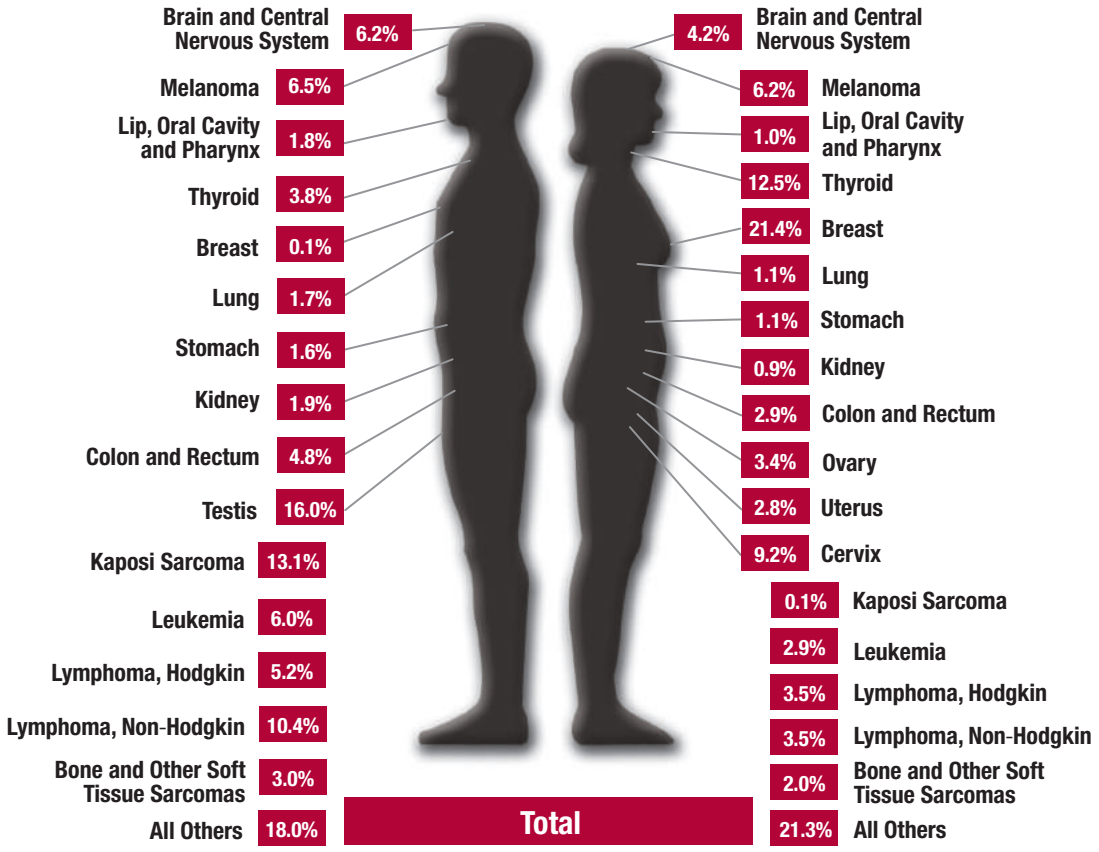
SITE	Total		Asian/Pacific Islander		Black		Latino White		Non-Latino White		Other	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Bone and Other Soft Tissue Sarcomas	60.2%	64.8%	61.0%	67.4%	53.0%	58.2%	58.3%	63.5%	64.4%	68.3%	80.0%	64.1%
Brain and Central Nervous System	64.2%	76.3%	62.4%	77.8%	54.5%	77.5%	64.6%	75.4%	64.6%	76.3%	84.3%	80.6%
Breast	84.4%	77.9%	—	84.6%	50.0%	66.4%	100.0%	74.2%	90.9%	82.5%	100.0%	88.5%
Cervix	—	78.7%	—	77.6%	—	65.9%	—	79.1%	—	82.2%	—	83.7%
Colon and Rectum	58.7%	62.2%	57.1%	63.7%	55.7%	59.5%	57.1%	61.8%	60.1%	61.6%	81.3%	80.7%
Kaposi Sarcoma	24.2%	37.0%	36.8%	0.0%	25.7%	26.7%	27.9%	35.7%	19.1%	50.0%	55.0%	—
Kidney	76.4%	84.5%	85.6%	76.0%	54.1%	76.6%	79.0%	86.7%	77.9%	87.1%	100.0%	75.0%
Leukemia	48.8%	48.8%	51.1%	50.3%	34.4%	37.9%	46.6%	48.3%	55.6%	53.3%	59.4%	50.2%
Lip, Oral Cavity and Pharynx	72.7%	81.8%	69.1%	72.9%	46.4%	75.8%	74.9%	82.0%	78.5%	86.3%	80.1%	92.3%
Lung	25.1%	32.4%	11.2%	20.8%	10.1%	26.0%	28.2%	36.9%	30.6%	37.8%	62.5%	0.0%
Lymphoma, Hodgkin	86.2%	93.2%	88.2%	95.3%	75.3%	90.6%	85.5%	91.4%	88.4%	94.6%	95.5%	95.7%
Lymphoma, Non-Hodgkin	45.5%	74.5%	64.4%	73.1%	40.7%	65.8%	45.1%	71.2%	43.2%	79.7%	82.0%	93.7%
Melanoma	86.7%	93.9%	68.6%	91.3%	91.7%	73.7%	75.3%	88.2%	87.2%	94.6%	98.4%	98.8%
Ovary	—	78.2%	—	77.0%	—	83.7%	—	76.6%	—	79.2%	—	83.2%
Stomach	20.0%	20.8%	24.8%	26.6%	12.7%	25.4%	20.1%	19.4%	18.6%	13.4%	28.6%	17.5%
Testis	92.5%	—	92.1%	—	92.1%	—	90.8%	—	93.9%	—	96.1%	—
Thyroid	97.7%	99.0%	98.3%	98.8%	97.4%	97.8%	95.6%	98.5%	98.9%	99.5%	100.0%	99.3%
Uterus	—	93.1%	—	91.5%	—	87.1%	—	94.5%	—	91.2%	—	100.0%

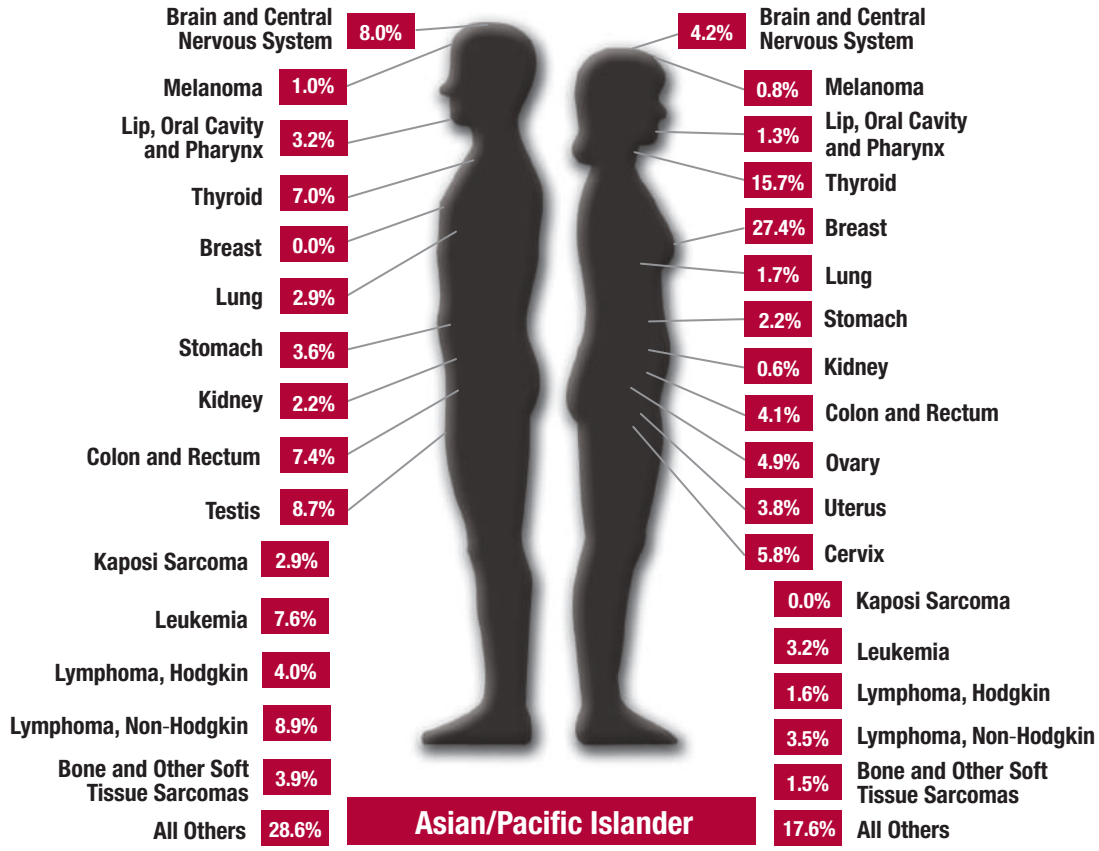
DISTRIBUTION OF AYA CANCER CASES

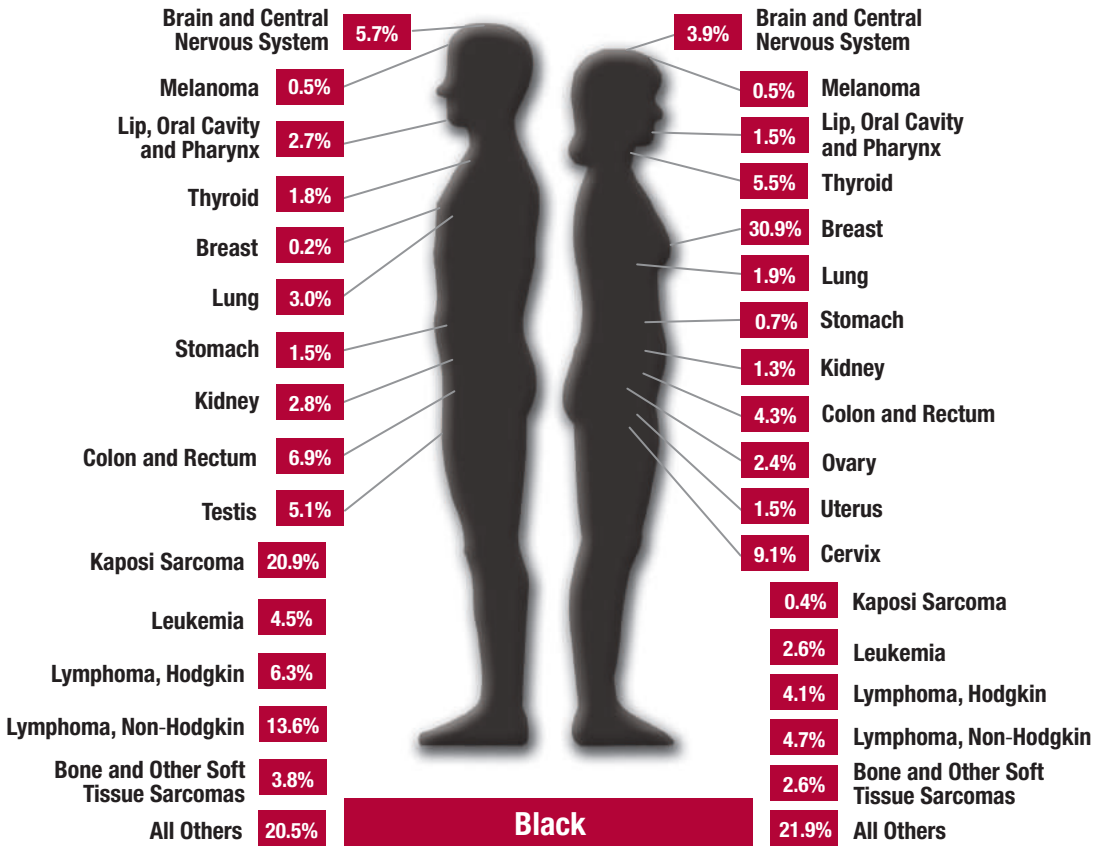
Here, we provide a pictorial overview of the percentage distributions of AYA cancer cases during 1988-2014 in Los Angeles County, according to the site on the body where they occur (anatomic site). We present figures for men and women separately and by race/ethnicity. For each racial/ethnic-sex group, the numbers shown are percentages of all AYA cancers combined for this group, and only the most common anatomic sites are individually displayed in the figure.

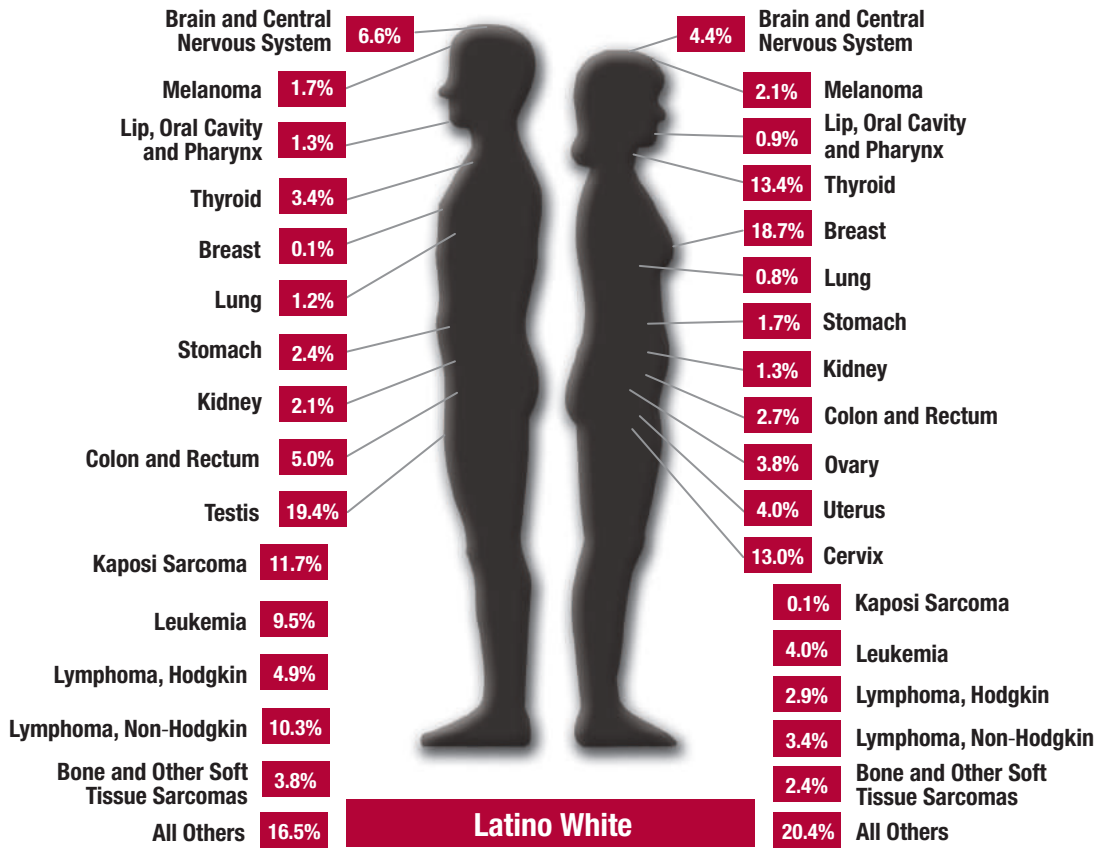
DISTRIBUTIONS OF CANCER CASES AMONG AYAS BY ANATOMIC SITE, RACE/ETHNICITY, AND SEX, LOS ANGELES COUNTY, 1988-2014

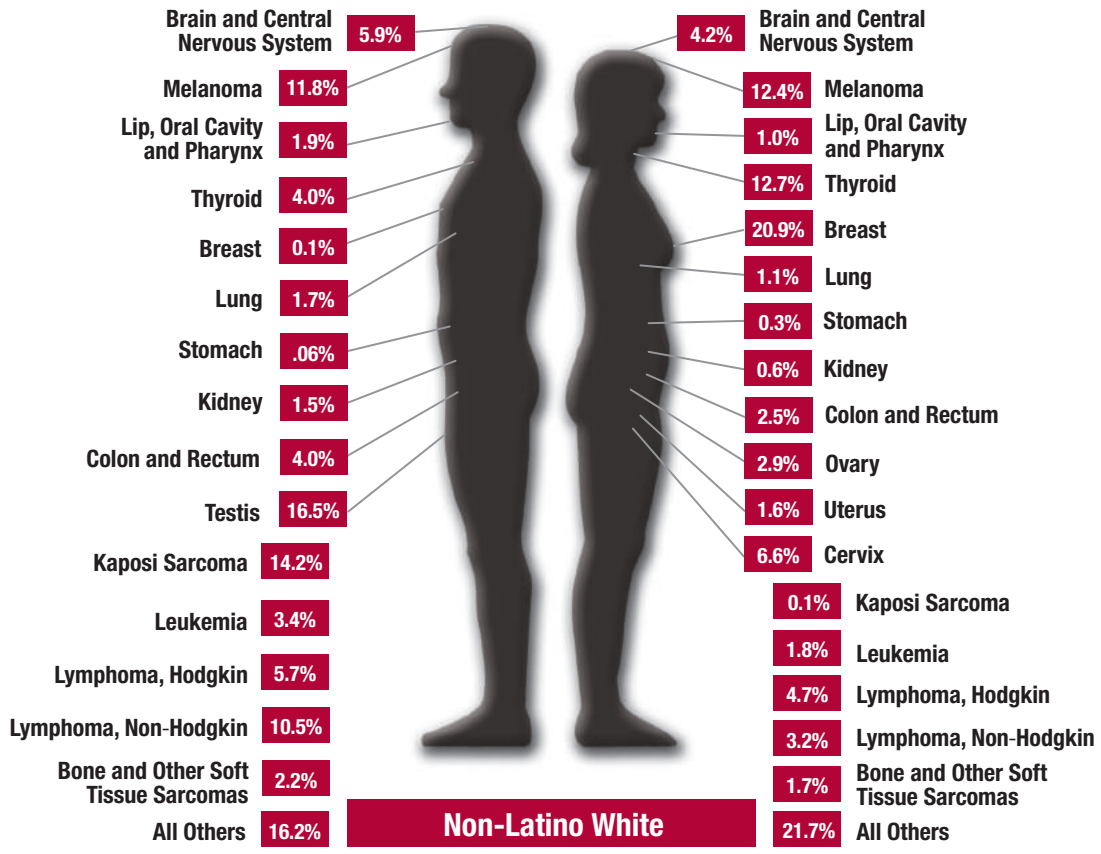
SITE	Total		Asian/Pacific Islander		Black		Latino White		Non-Latino White		Other	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
All Others	18.0%	21.3%	28.6%	17.6%	20.5%	21.9%	16.5%	20.4%	16.2%	21.7%	29.9%	34.2%
Bone and Other Soft Tissue Sarcomas	3.0%	2.0%	3.9%	1.5%	3.8%	2.6%	3.8%	2.4%	2.2%	1.7%	1.2%	1.2%
Brain and Central Nervous System	6.2%	4.2%	8.0%	4.2%	5.7%	3.9%	6.6%	4.4%	5.9%	4.2%	4.6%	3.2%
Breast	0.1%	21.4%	0.0%	27.4%	0.2%	30.9%	0.1%	18.7%	0.1%	20.9%	0.1%	12.4%
Cervix	—	9.2%	—	5.8%	—	9.1%	—	13.0%	—	6.6%	—	6.1%
Colon and Rectum	4.8%	2.9%	7.4%	4.1%	6.9%	4.3%	5.0%	2.7%	4.0%	2.5%	3.7%	2.2%
Kaposi Sarcoma	13.1%	0.1%	2.9%	0.0%	20.9%	0.4%	11.7%	0.1%	14.2%	0.1%	15.2%	0.0%
Kidney	1.9%	0.9%	2.2%	0.6%	2.8%	1.3%	2.1%	1.3%	1.5%	0.6%	0.9%	0.4%
Leukemia	6.0%	2.9%	7.6%	3.2%	4.5%	2.6%	9.5%	4.0%	3.4%	1.8%	3.5%	1.4%
Lip, Oral Cavity and Pharynx	1.8%	1.0%	3.2%	1.3%	2.7%	1.5%	1.3%	0.9%	1.9%	1.0%	1.6%	1.0%
Lung	1.7%	1.1%	2.9%	1.7%	3.0%	1.9%	1.2%	0.8%	1.7%	1.1%	0.8%	0.5%
Lymphoma, Hodgkin	5.2%	3.5%	4.0%	1.6%	6.3%	4.1%	4.9%	2.9%	5.7%	4.7%	2.6%	2.1%
Lymphoma, Non-Hodgkin	10.4%	3.5%	8.9%	3.5%	13.6%	4.7%	10.3%	3.4%	10.5%	3.2%	4.7%	3.7%
Melanoma	6.5%	6.2%	1.0%	0.8%	0.5%	0.5%	1.7%	2.1%	11.8%	12.4%	15.0%	13.8%
Ovary	—	3.4%	—	4.9%	—	2.4%	—	3.8%	—	2.9%	—	2.1%
Stomach	1.6%	1.1%	3.6%	2.2%	1.5%	0.7%	2.4%	1.7%	0.6%	0.3%	0.6%	0.5%
Testis	16.0%	—	8.7%	—	5.1%	—	19.4%	—	16.5%	—	12.5%	—
Thyroid	3.8%	12.5%	7.0%	15.7%	1.8%	5.5%	3.4%	13.4%	4.0%	12.7%	3.2%	12.0%
Uterus	—	2.8%	—	3.8%	—	1.5%	—	4.0%	—	1.6%	—	3.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

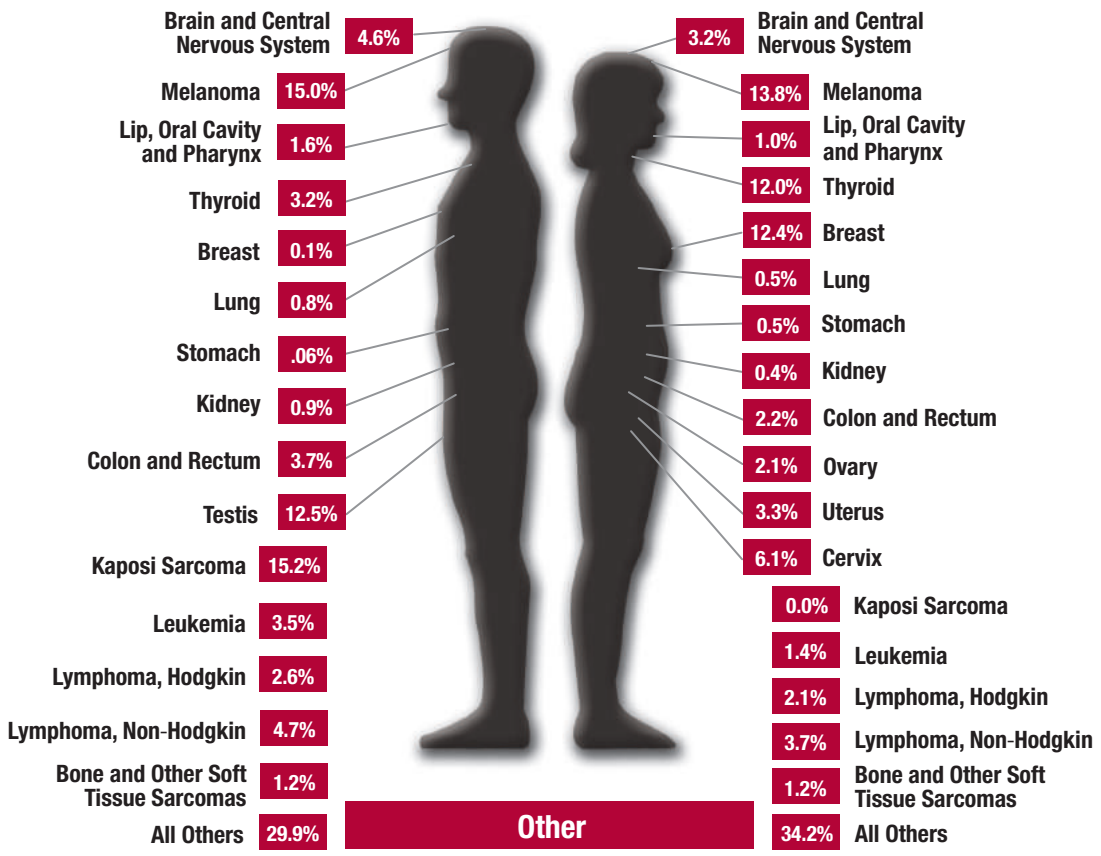

Brain and Central Nervous System 6.2%
Melanoma 6.5%
Lip, Oral Cavity and Pharynx 1.8%
Thyroid 3.8%
Breast 0.1%
Lung 1.7%
Stomach 1.6%
Kidney 1.9%
Colon and Rectum 4.8%
Testis 16.0%
Kaposi Sarcoma 13.1%
Leukemia 6.0%
Lymphoma, Hodgkin 5.2%
Lymphoma, Non-Hodgkin 10.4%
Bone and Other Soft Tissue Sarcomas 3.0%
All Others 18.0%
Total
4.2% Brain and Central Nervous System
6.2% Melanoma
1.0% Lip, Oral Cavity and Pharynx
12.5% Thyroid
21.4% Breast
1.1% Lung
1.1% Stomach
0.9% Kidney
2.9% Colon and Rectum
3.4% Ovary
2.8% Uterus
9.2% Cervix
0.1% Kaposi Sarcoma
2.9% Leukemia
3.5% Lymphoma, Hodgkin
3.5% Lymphoma, Non-Hodgkin
2.0% Bone and Other Soft Tissue Sarcomas
21.3% All Others


Brain and Central Nervous System 8.0%
Melanoma 1.0%
Lip, Oral Cavity and Pharynx 3.2%
Thyroid 7.0%
Breast 0.0%
Lung 2.9%
Stomach 3.6%
Kidney 2.2%
Colon and Rectum 7.4%
Testis 8.7%
Kaposi Sarcoma 2.9%
Leukemia 7.6%
Lymphoma, Hodgkin 4.0%
Lymphoma, Non-Hodgkin 8.9%
Bone and Other Soft Tissue Sarcomas 3.9%
All Others 28.6%
Asian/Pacific Islander
4.2% Brain and Central Nervous System
0.8% Melanoma
1.3% Lip, Oral Cavity and Pharynx
15.7% Thyroid
27.4% Breast
1.7% Lung
2.2% Stomach
0.6% Kidney
4.1% Colon and Rectum
4.9% Ovary
3.8% Uterus
5.8% Cervix
0.0% Kaposi Sarcoma
3.2% Leukemia
1.6% Lymphoma, Hodgkin
3.5% Lymphoma, Non-Hodgkin
1.5% Bone and Other Soft Tissue Sarcomas
17.6% All Others


Brain and Central Nervous System 5.7%
Melanoma 0.5%
Lip, Oral Cavity and Pharynx 2.7%
Thyroid 1.8%
Breast 0.2%
Lung 3.0%
Stomach 1.5%
Kidney 2.8%
Colon and Rectum 6.9%
Testis 5.1%
Kaposi Sarcoma 20.9%
Leukemia 4.5%
Lymphoma, Hodgkin 6.3%
Lymphoma, Non-Hodgkin 13.6%
Bone and Other Soft Tissue Sarcomas 3.8%
All Others 20.5%
Black
3.9% Brain and Central Nervous System
0.5% Melanoma
1.5% Lip, Oral Cavity and Pharynx
5.5% Thyroid
30.9% Breast
1.9% Lung
0.7% Stomach
1.3% Kidney
4.3% Colon and Rectum
2.4% Ovary
1.5% Uterus
9.1% Cervix
0.4% Kaposi Sarcoma
2.6% Leukemia
4.1% Lymphoma, Hodgkin
4.7% Lymphoma, Non-Hodgkin
2.6% Bone and Other Soft Tissue Sarcomas
21.9% All Others


Brain and Central Nervous System 6.6%
Melanoma 1.7%
Lip, Oral Cavity and Pharynx 1.3%
Thyroid 3.4%
Breast 0.1%
Lung 1.2%
Stomach 2.4%
Kidney 2.1%
Colon and Rectum 5.0%
Testis 19.4%
Kaposi Sarcoma 11.7%
Leukemia 9.5%
Lymphoma, Hodgkin 4.9%
Lymphoma, Non-Hodgkin 10.3%
Bone and Other Soft Tissue Sarcomas 3.8%
All Others 16.5%
Latino White
4.4% Brain and Central Nervous System
2.1% Melanoma
0.9% Lip, Oral Cavity and Pharynx
13.4% Thyroid
18.7% Breast
0.8% Lung
1.7% Stomach
1.3% Kidney
2.7% Colon and Rectum
3.8% Ovary
4.0% Uterus
13.0% Cervix
0.1% Kaposi Sarcoma
4.0% Leukemia
2.9% Lymphoma, Hodgkin
3.4% Lymphoma, Non-Hodgkin
2.4% Bone and Other Soft Tissue Sarcomas
20.4% All Others


Brain and Central Nervous System 5.9%
Melanoma 11.8%
Lip, Oral Cavity and Pharynx 1.9%
Thyroid 4.0%
Breast 0.1%
Lung 1.7%
Stomach .06%
Kidney 1.5%
Colon and Rectum 4.0%
Testis 16.5%
Kaposi Sarcoma 14.2%
Leukemia 3.4%
Lymphoma, Hodgkin 5.7%
Lymphoma, Non-Hodgkin 10.5%
Bone and Other Soft Tissue Sarcomas 2.2%
All Others 16.2%
Non-Latino White
4.2% Brain and Central Nervous System
12.4% Melanoma
1.0% Lip, Oral Cavity and Pharynx
12.7% Thyroid
20.9% Breast
1.1% Lung
0.3% Stomach
0.6% Kidney
2.5% Colon and Rectum
2.9% Ovary
1.6% Uterus
6.6% Cervix
0.1% Kaposi Sarcoma
1.8% Leukemia
4.7% Lymphoma, Hodgkin
3.2% Lymphoma, Non-Hodgkin
1.7% Bone and Other Soft Tissue Sarcomas
21.7% All Others


Brain and Central Nervous System 4.6%
Melanoma 15.0%
Lip, Oral Cavity and Pharynx 1.6%
Thyroid 3.2%
Breast 0.1%
Lung 0.8%
Stomach .06%
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Colon and Rectum 3.7%
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Lymphoma, Hodgkin 2.6%
Lymphoma, Non-Hodgkin 4.7%
Bone and Other Soft Tissue Sarcomas 1.2%
All Others 29.9%
Other
3.2% Brain and Central Nervous System
13.8% Melanoma
1.0% Lip, Oral Cavity and Pharynx
12.0% Thyroid
12.4% Breast
0.5% Lung
0.5% Stomach
0.4% Kidney
2.2% Colon and Rectum
2.1% Ovary
3.3% Uterus
6.1% Cervix
0.0% Kaposi Sarcoma
1.4% Leukemia
2.1% Lymphoma, Hodgkin
3.7% Lymphoma, Non-Hodgkin
1.2% Bone and Other Soft Tissue Sarcomas
34.2% All Others

BONE AND OTHER SOFT TISSUE SARCOMAS

Amie E. Hwang, PhD
Troy A. McEachron, PhD
Leo Mascarenhas, MD
James S. Hu, MD

BACKGROUND

Sarcomas are rare cancers that arise in connective tissues of the body such as bone, muscle, fat, nerves and tendons. They make up about 0.2% of all newly diagnosed cancers in the United States. Sarcomas occur most commonly in the adolescent and young adult (AYA) age group (15-39 years old) and account for about 6% of cancers in AYAs. There are numerous subtypes of sarcomas, each of which is extremely rare. The established risk factors are exposure to certain chemicals, radiation, and certain genetic conditions. Sarcoma patients are typically treated with surgery, radiation and chemotherapy depending on the subtype and severity of the disease. The two major groups of sarcomas are bone cancer and soft tissue sarcoma.

Bone cancer occurs when there is an excess of the cells that make up the formation of bone, called osteoblasts. Bone cancer accounts for about 3% of all cancers in the AYA age group, and consists of multiple different subtypes. The two main subtypes of AYA bone sarcomas are osteosarcoma and Ewing sarcoma. Osteosarcoma is the most common bone cancer in adolescents. Ewing sarcoma arises from bone or soft tissue of the trunk, arm, legs, head and neck, abdomen or other areas. Despite research efforts to reduce bone cancer deaths, survival from bone cancer has not improved significantly in the last few decades, especially for those with late stage* disease. If bone cancer has spread to distant sites in the body, survival is poor.

Soft tissue sarcoma (STS) is a cancer of the soft tissues, such as muscle, fat, blood vessels, nerves, tendons and the lining of bones and joints. STS occurs most frequently in young adults and can be quite deadly due to its tendency to be diagnosed at late stage*. Survival for STS is lower than other AYA cancers. Compared to other bone sarcomas or sarcomas in adult patients, STS in AYAs have not been studied extensively due to the rarity and wide diversity of subtypes.

AYA SURVIVAL IN LOS ANGELES COUNTY

In Los Angeles County from 1988 to 2014, 641 bone cancers and 1,086 STS were diagnosed in the AYA population. Stage* at diagnosis is the most important determinant of survival. Group-specific survival patterns for bone cancer and STS are described as follows.

Bone cancer: Women with bone cancer tend to have slightly higher survival than men (Table 1, Figure 1A). Survival rates are higher in non-Latino whites and Asian/Pacific Islanders compared to Latino whites and blacks (Table 1, Figure 3A). Those diagnosed between 25 and 34 years of age have better 5-year survival than the other age groups (Table 1, Figure 2A). There seems to be no relationship between socioeconomic status (SES) and either stage* at diagnosis or survival (Table 1, Figure 4A). Survival is much better if diagnosed early. The 5-year survival rate is 73% for early stage* as compared to 26% for late stage* when cancer has spread to distant parts of the body (Table 1, Figure 5A).

Soft Tissue Sarcoma (STS): For STS, survival rates are lower in men than women (Table 1, Figure 1B), and black patients experience the lowest survival rates compared to other races (Table 1, Figure 3B). Survival rates do not noticeably differ by age at diagnosis (Table 1, Figure 2B) or SES (Table 1, Figure 4B). Patients with late stage* disease with distant metastases carry the highest burden of death. The 5-year survival for late stage* disease with distant metastases is considerably lower at 17% compared to that of early stage* disease at 83% (Table 1, Figure 5B).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, BONE CANCER AND OTHER SOFT TISSUE SARCOMAS, LOS ANGELES COUNTY, 1988-2014

Bone Cancer and Other Soft Tissue Sarcomas	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Bone Cancer																					
Number of Cases	378	263	—	410	177	54	56	55	317	204	<10	108	108	140	142	137	<10	189	270	138	44
Percent of Cases	59.0%	41.0%	—	64.0%	27.6%	8.4%	8.7%	8.6%	49.5%	31.8%	—	16.8%	16.8%	21.8%	22.2%	21.4%	—	29.5%	42.1%	21.5%	6.9%
1-year survival	86.4%	87.9%	—	86.7%	87.2%	88.2%	87.4%	86.9%	84.1%	91.4%	—	91.2%	84.7%	91.2%	82.8%	85.9%	—	93.0%	92.8%	66.8%	90.1%
3-year survival	62.8%	69.1%	—	63.4%	69.6%	65.5%	72.0%	62.4%	62.3%	68.9%	—	66.0%	71.0%	64.4%	59.4%	66.5%	—	78.2%	76.2%	34.6%	40.1%
5-year survival	55.4%	60.7%	—	54.8%	64.1%	56.5%	63.9%	52.3%	53.4%	63.2%	—	59.9%	62.2%	54.0%	51.4%	60.6%	—	72.8%	67.1%	25.8%	34.4%
Other Soft Tissue Sarcomas																					
Number of Cases	523	563	<10	248	462	377	89	138	486	349	25	182	194	214	246	239	12	631	212	160	84
Percent of Cases	48.1%	51.8%	—	22.8%	42.5%	34.7%	8.2%	12.7%	44.7%	32.1%	2.3%	16.7%	17.8%	19.7%	22.6%	22.0%	1.1%	58.0%	19.5%	14.7%	7.7%
1-year survival	83.6%	86.6%	—	86.1%	86.4%	83.2%	86.3%	81.4%	85.8%	85.0%	95.8%	84.0%	87.8%	85.9%	85.1%	83.1%	—	95.6%	85.0%	45.8%	85.2%
3-year survival	70.4%	74.5%	—	70.8%	74.0%	71.9%	70.3%	63.6%	73.3%	75.4%	76.2%	73.6%	76.1%	70.5%	72.5%	70.4%	—	88.5%	67.6%	22.3%	66.6%
5-year survival	63.8%	66.8%	—	62.4%	67.7%	64.5%	63.6%	57.2%	65.8%	68.1%	76.2%	66.9%	67.3%	64.7%	65.5%	62.5%	—	82.5%	56.2%	17.2%	57.7%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, BONE CANCER AND OTHER SOFT TISSUE SARCOMAS, LOS ANGELES COUNTY, 1988-2014

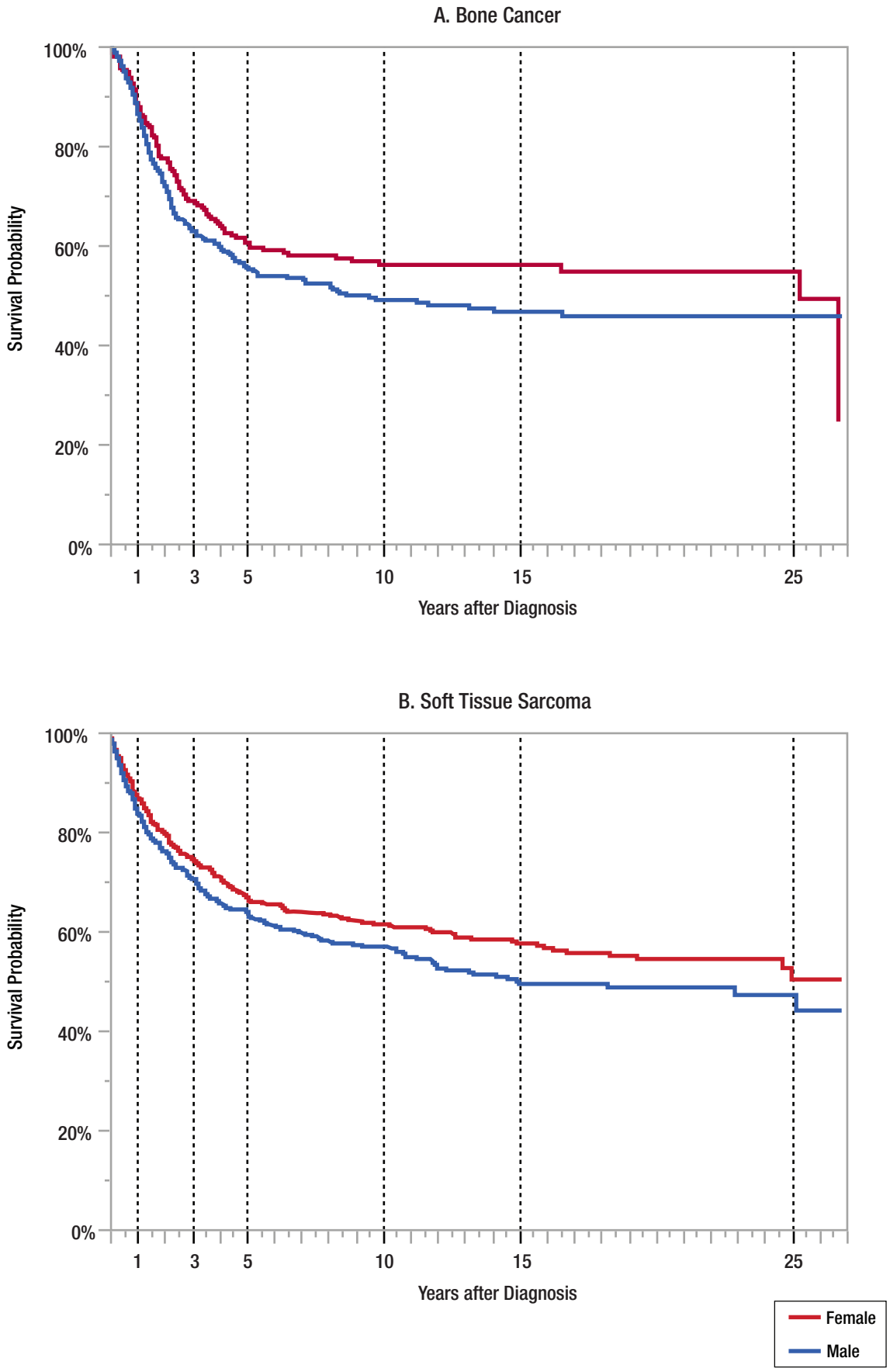


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, BONE CANCER AND OTHER SOFT TISSUE SARCOMAS, LOS ANGELES COUNTY, 1988-2014

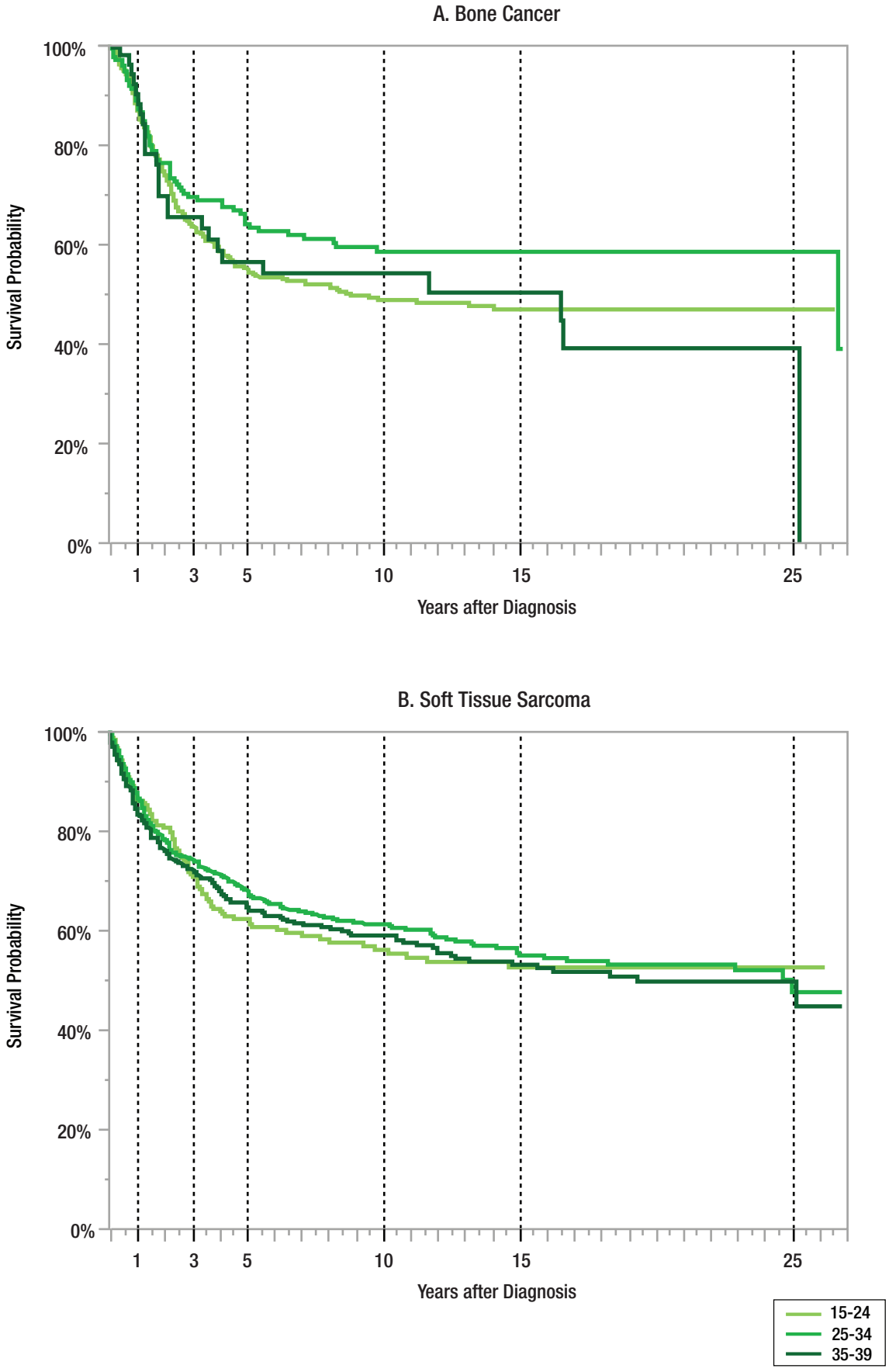


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, BONE CANCER AND OTHER SOFT TISSUE SARCOMAS, LOS ANGELES COUNTY, 1988-2014

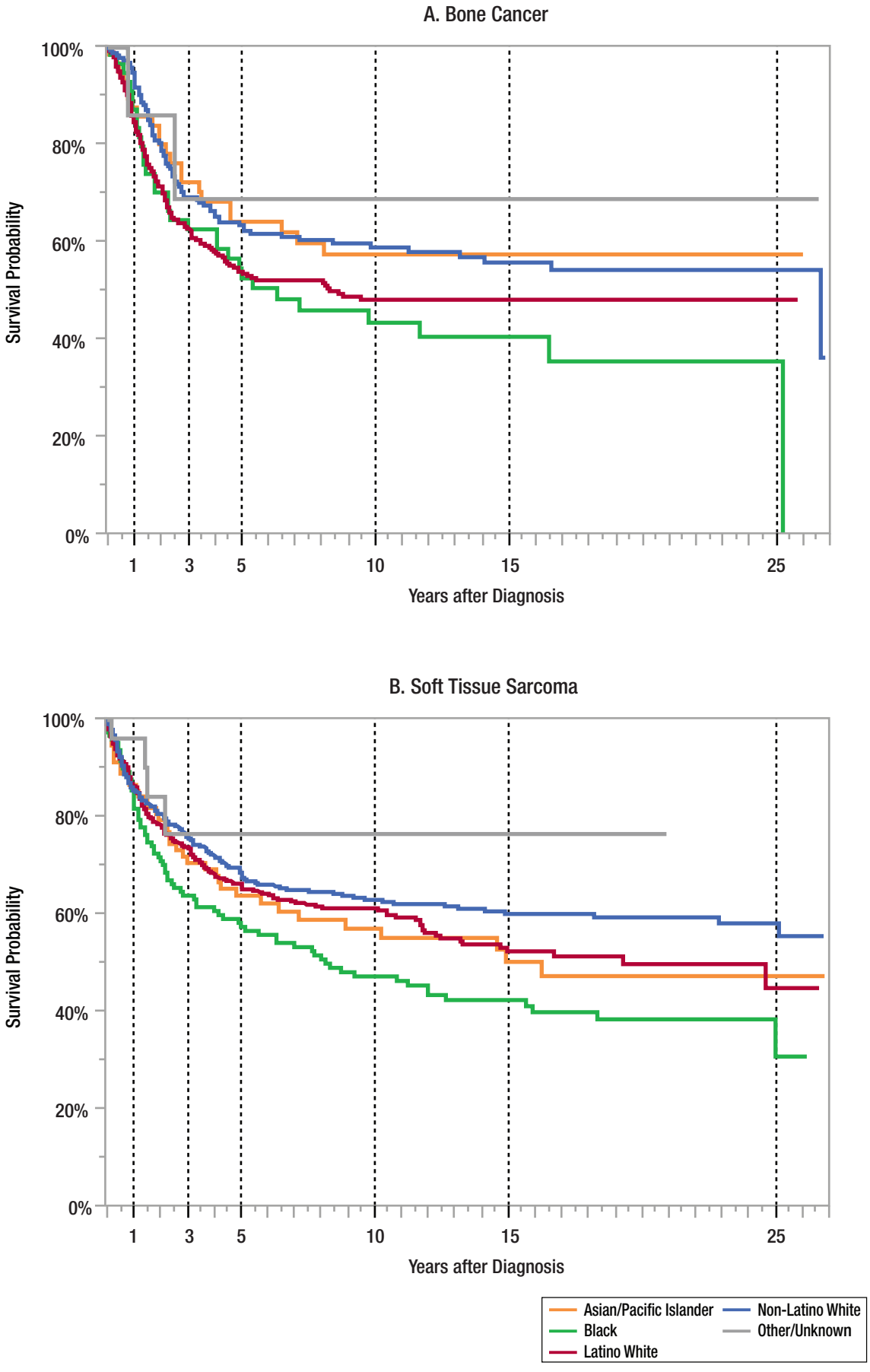


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, BONE CANCER AND OTHER SOFT TISSUE SARCOMAS, LOS ANGELES COUNTY, 1988-2014

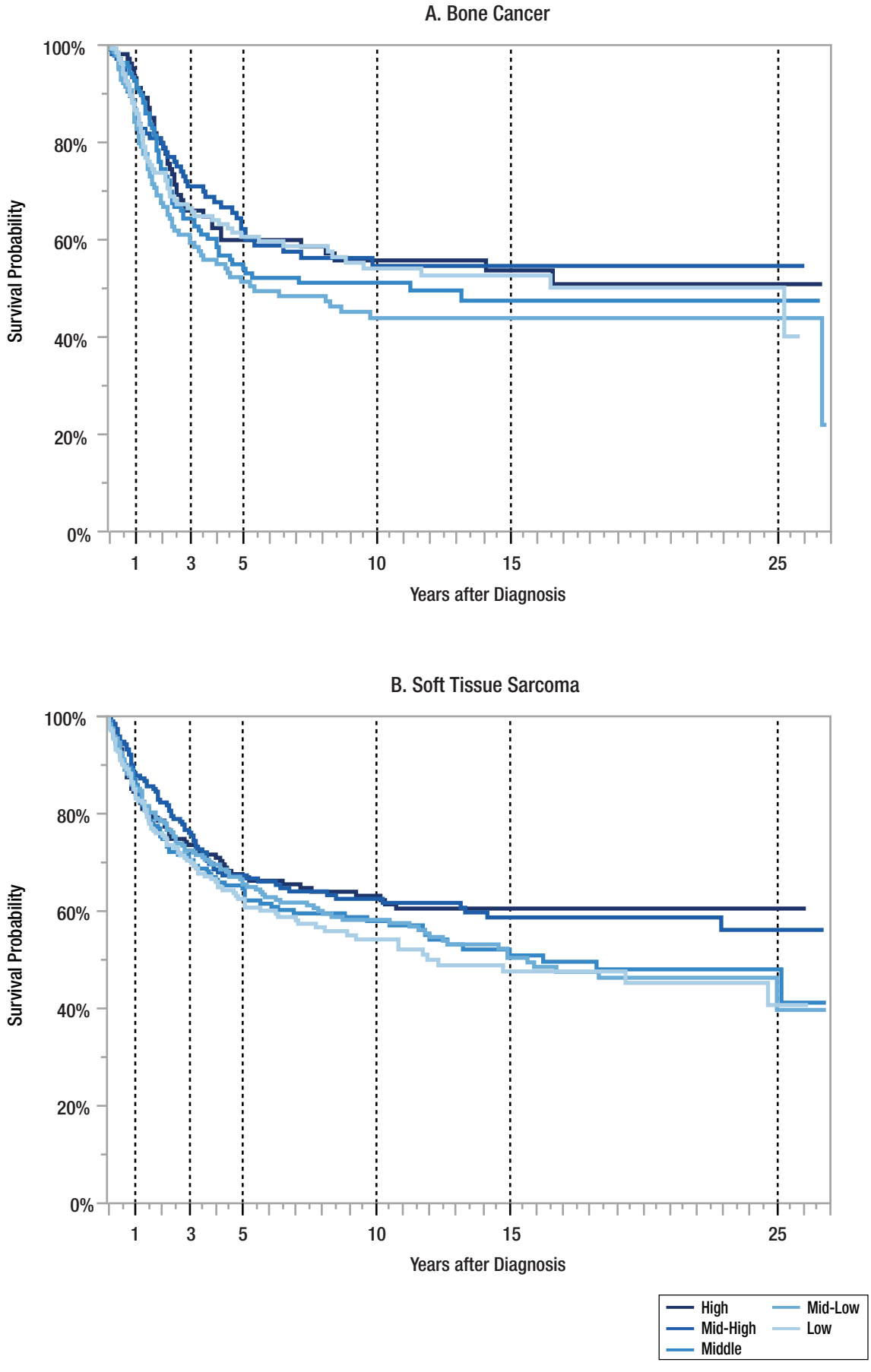
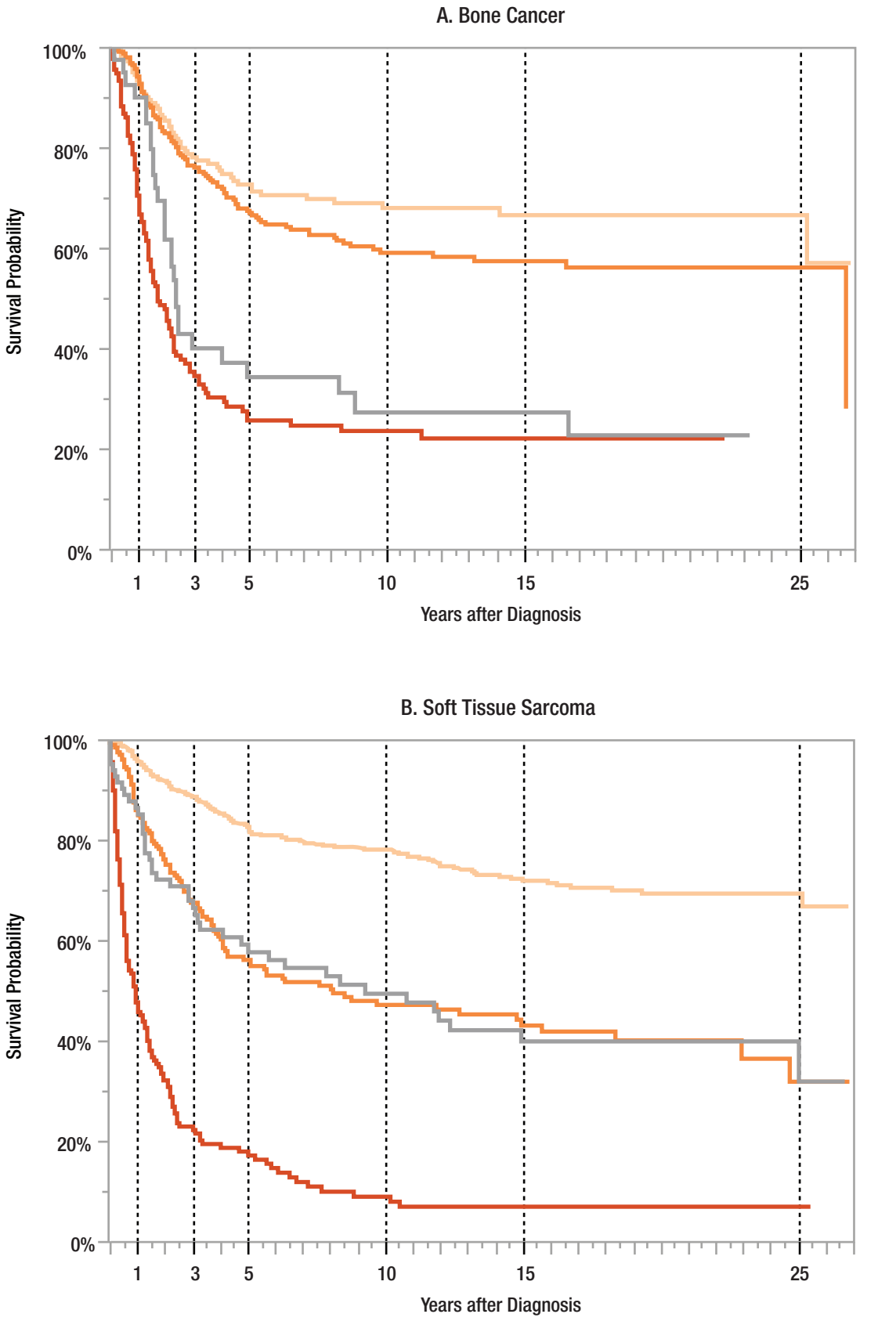


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, BONE CANCER AND OTHER SOFT TISSUE SARCOMAS, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

BRAIN AND CENTRAL NERVOUS SYSTEM

Roberta McKean-Cowdin, PhD
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Girish Dhall, MD

BACKGROUND

Approximately 10,600 malignant brain and central nervous system (CNS) tumors are diagnosed in adolescents and young adults (AYAs) 15-39 years of age in the U.S. each year, and cause about 450 AYA deaths. Brain and CNS cancer is the most common cause of cancer-related deaths in AYAs. It is the most common cancer among younger AYAs (15-19 years old) and third most common cancer among older AYAs (34-39 years old). Brain and CNS tumors in AYAs are distinctly different from those of younger children and older adults.

Brain and CNS tumors include more than 100 different types and subtypes. It is thought that different subtypes have different risk factors. Age, race/ethnicity, sex, and several rare genetic syndromes and genetic mutations are associated with risk of these tumors. Radiation is a cause of brain tumors, however it is uncommon. Beyond radiation, many suspected environmental causes of brain tumors in children and AYAs have been investigated, but none has been found to cause brain tumors.

The treatment of brain and CNS tumors depends on the location and the subtype. Surgical removal is recommended for most brain and CNS tumors if it can be done safely. Complete surgical removal can cure some slow growing tumors. However, many tumors require more therapy with radiation and/or chemotherapy. Incompletely removed slow growing tumors and almost all aggressive brain and CNS tumors are typically treated with radiation and chemotherapy. The chemotherapy depends on the subtype and, occasionally, some cancer cell biomarkers.

AYA SURVIVAL IN LOS ANGELES COUNTY

In 1988-2014, there were 3,585 AYAs diagnosed with invasive brain or CNS tumors in Los Angeles County. The majority of cases are non-Latino white (40%) or Latino white (40%) compared to Asian/Pacific Islander (10%), black (8%) or other (3%) (Table 1). The probability of surviving 5 years after diagnosis is 64% for men and 76% for women (Table 1, Figure 1). Higher 5-year survival rate is found among AYAs diagnosed at 15-24 years of age (73%) compared to 25-34 years (69%) and 35-39 years (69%) (Table 1, Figure 2). The higher survival rate in AYAs 15-24 years of age is at least partially due to the higher proportion of some slow growing subtypes in this age group, that generally have good outcomes. Better survival also is found among AYAs in the highest socioeconomic status (SES) (5-year survival 73%) compared to lower SES groups (mid-high 71%, medium 70%, mid-low 70%, and low 67%) (Table 1, Figure 4). No differences in 5-year survival are observed for the four most common racial/ethnic groups: 71% for Asian/Pacific Islander, 67% black, 70% Latino white, and 70% non-Latino white (Table 1, Figure 3). The 5-year survival rate for early diagnosed cancer (76%) is much better than for those diagnosed at a later stage* (44% and 34%) (Table 1, Figure 5).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, BRAIN AND CENTRAL NERVOUS SYSTEM CANCER, LOS ANGELES COUNTY, 1988-2014

Brain and Central Nervous System Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	1,846	1,739	—	878	1,542	1,165	345	287	1,421	1,425	107	698	764	726	681	684	32	2,995	385	58	147
Percent of Cases	51.5%	48.5%	—	24.5%	43.0%	32.5%	9.6%	8.0%	39.6%	39.7%	3.0%	19.5%	21.3%	20.3%	19.0%	19.1%	0.9%	83.5%	10.7%	1.6%	4.1%
1-year survival	85.5%	91.6%	—	88.6%	88.8%	88.0%	86.9%	86.0%	87.3%	90.0%	96.0%	90.9%	90.8%	88.1%	88.8%	83.6%	—	91.9%	74.5%	59.0%	67.1%
3-year survival	71.5%	82.0%	—	78.1%	76.3%	76.0%	76.1%	74.7%	75.8%	77.0%	88.6%	78.1%	77.9%	76.6%	76.6%	73.6%	—	81.7%	54.5%	38.0%	49.6%
5-year survival	64.2%	76.3%	—	73.2%	69.4%	68.5%	70.5%	66.8%	69.9%	69.9%	82.5%	72.5%	70.5%	70.1%	69.7%	67.4%	—	75.8%	44.1%	33.9%	40.1%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, BRAIN AND CENTRAL NERVOUS SYSTEM CANCER, LOS ANGELES COUNTY, 1988-2014

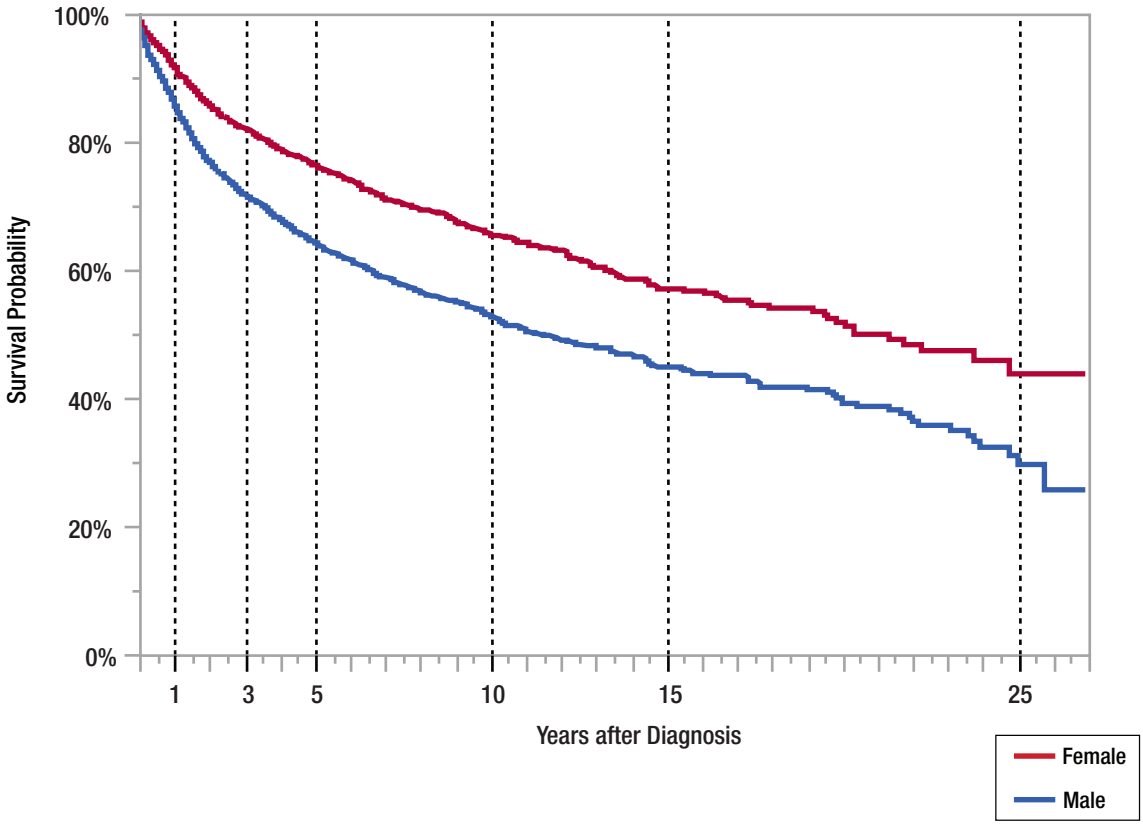


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, BRAIN AND CENTRAL NERVOUS SYSTEM CANCER, LOS ANGELES COUNTY, 1988-2014

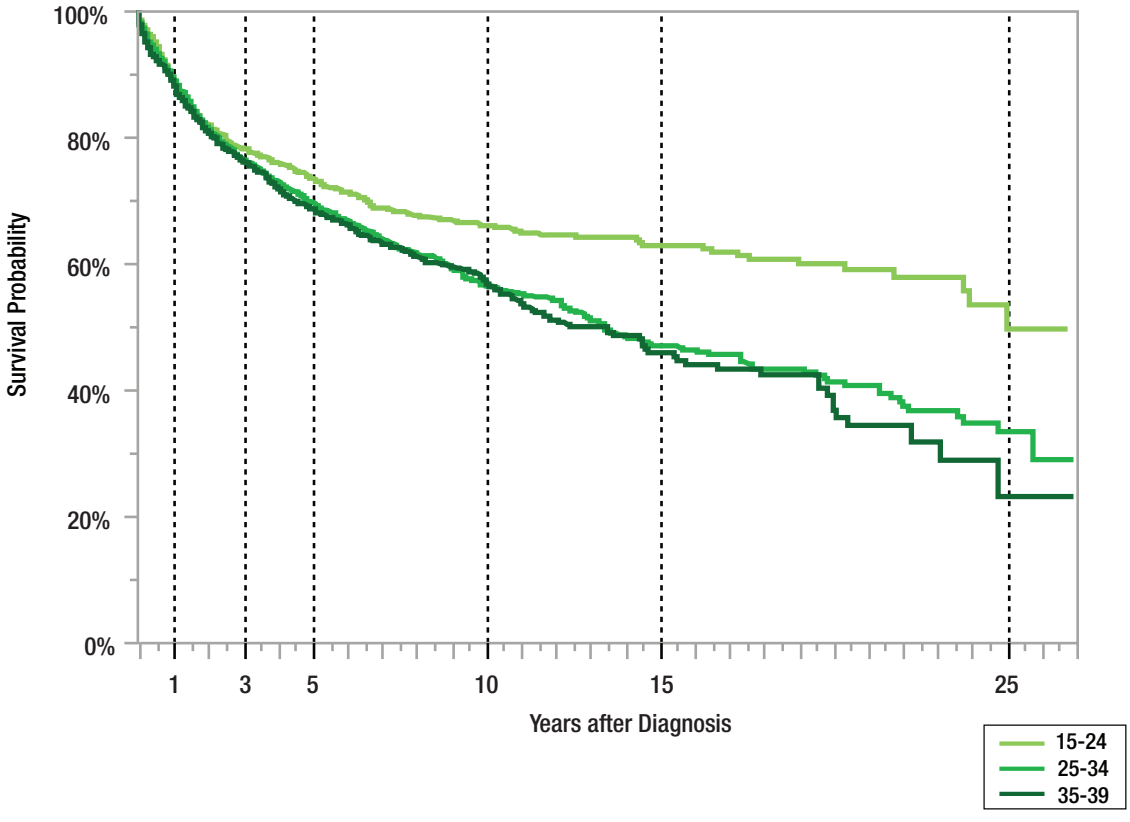


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, BRAIN AND CENTRAL NERVOUS SYSTEM CANCER, LOS ANGELES COUNTY, 1988-2014

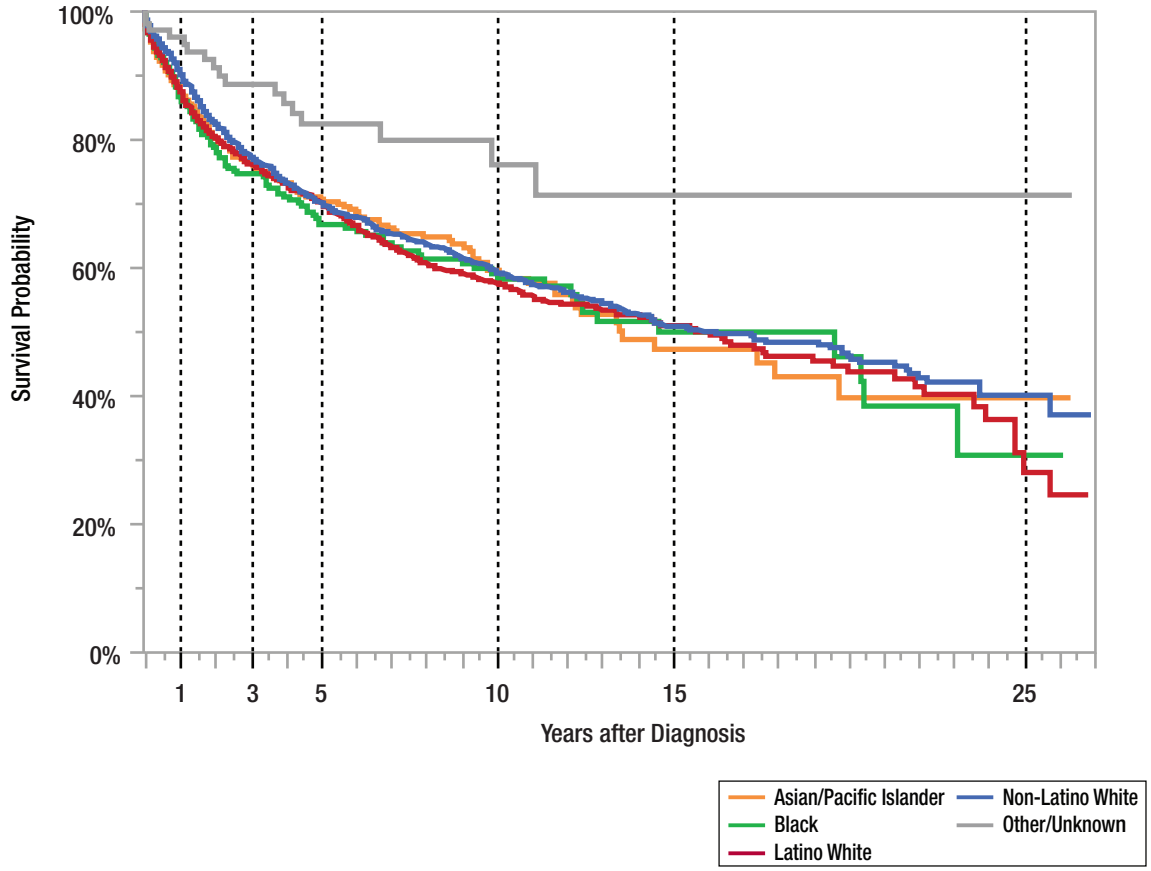


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, BRAIN AND CENTRAL NERVOUS SYSTEM CANCER, LOS ANGELES COUNTY, 1988-2014

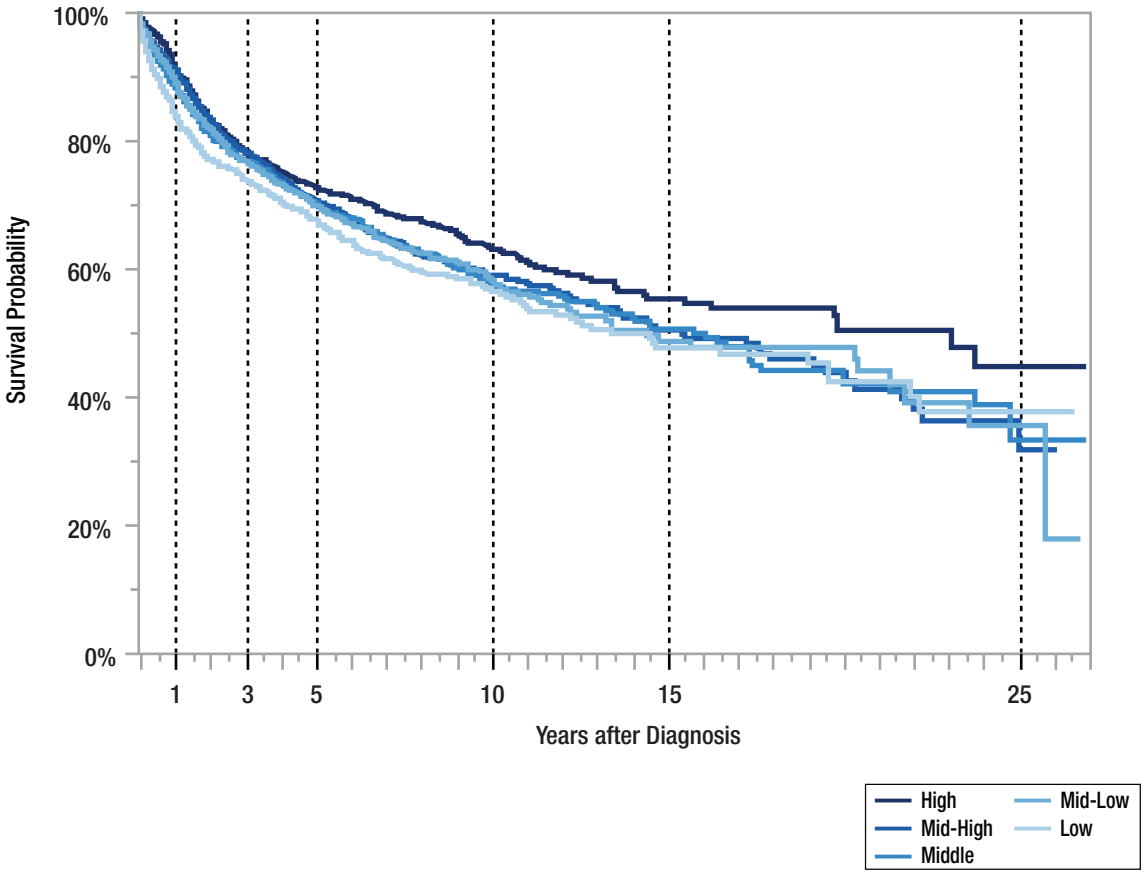
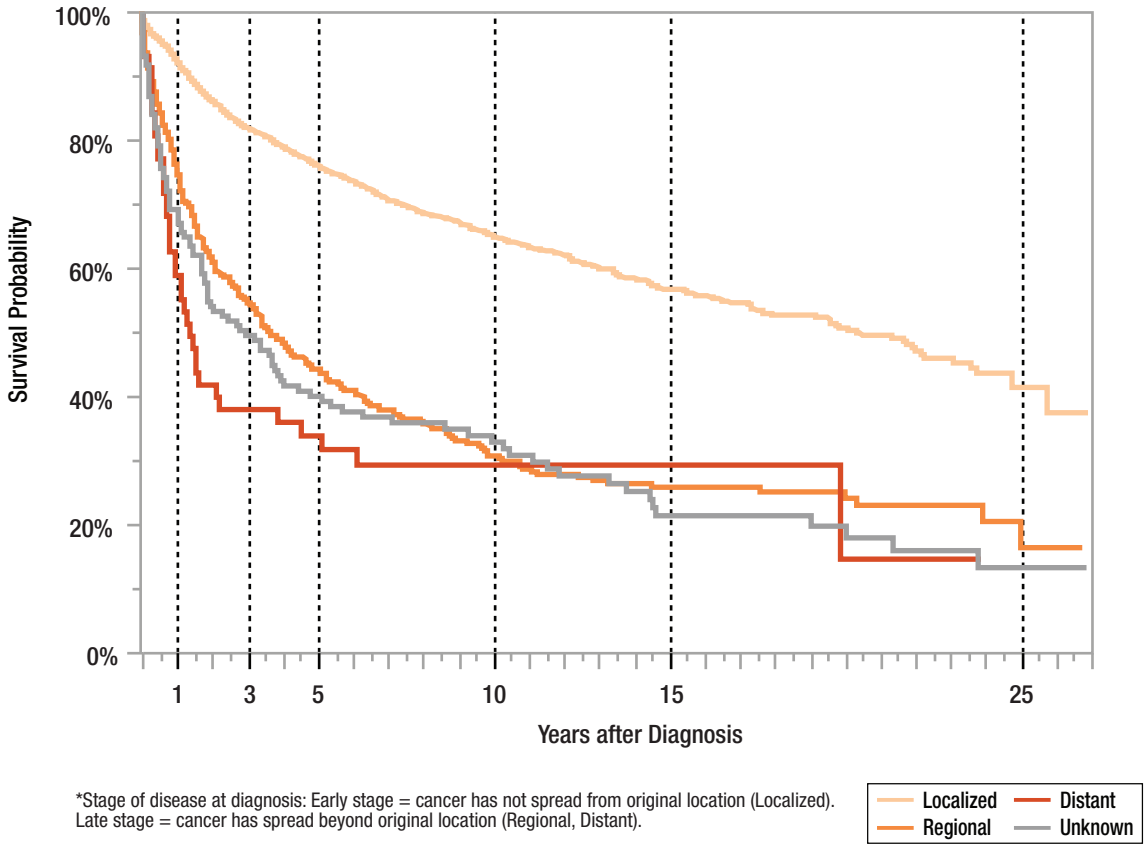


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, BRAIN AND CENTRAL NERVOUS SYSTEM CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

BREAST

Carrie Tayour, PhD
Christy A. Russell, MD

BACKGROUND

Breast cancer is the most common cancer among women of all ages worldwide, including adolescent and young adult (AYA) women. It happens most in non-Latina white and black women followed by Latina white women and least in Asian/Pacific Islanders. Risk factors for breast cancer include family history of breast cancer, certain genetic mutations (BRCA1 and BRCA2), beginning menstrual periods at a young age, older age at menopause, few or no pregnancies, radiation treatment to the chest, use of hormone replacement therapy after menopause, and alcohol consumption. Younger age at first full-term pregnancy, breastfeeding and regular physical activity reduce breast cancer risk. Obesity increases breast cancer risk in older women but reduces breast cancer risk in younger women. Because the majority of these risk factors cannot be easily modified, (other than weight, physical activity and alcohol consumption), screening and early detection are very important.

Despite the fact that breast cancer risk increases with age, breast cancer accounts for 24% of all cancers among AYA women. AYA women tend to be diagnosed with more advanced disease resulting in worse prognosis than older women. Some of this is because routine mammogram screening for breast cancer doesn't begin until ages 40-50 (mammograms are less effective in younger women). Thus the diagnosis tends to be delayed in younger women who are not screened. In addition, younger women have more rapid growing and aggressive types of breast cancer. Breast cancer is the second most common cancer-related death among women nationwide, but it is the leading cause of cancer-related deaths among AYA women. Five-year survival rates are the lowest for AYA women.

Once a diagnosis of breast cancer is made, it is evaluated for size, grade, number of draining lymph nodes involved, whether the cancer is dependent upon estrogen or progesterone to grow, and whether there is overproduction of HER2neu protein. The cancer is removed from the breast and the draining lymph nodes are assessed for any spread of disease. All of this information is used to decide whether additional radiation, chemotherapy, and/or estrogen blocking therapy are necessary. The standard use of screening mammography and the development of current treatments have led to an approximate 40% drop in death rates from breast cancer between 1991 and 2015. Women presenting with late stage are currently not curable, but their survival is increasing with continued improvements in chemotherapy and hormone therapy

AYA SURVIVAL IN LOS ANGELES COUNTY

The following trends are described mostly for AYA women in Los Angeles County during 1988-2014 due to the very small numbers of breast cancer diagnosed among AYA men. The number of breast cancer cases increases with age group. The majority (62%) of breast cancer cases occur among women 35-39 years of age (Table 1). Five-year survival rates are substantially lower for women in the youngest age groups (Table 1, Figure 2). The number of breast cancer cases in AYA women is highest among non- Latina white and Latina white women, followed by black and Asian/Pacific Islander women (Table 1). Five-year survival rates in AYA women are lowest for black women, followed by Latina white women (Table 1, Figure 3). Asian/Pacific Islander women have the highest 5-year survival rates among AYA women, followed by non-Latina white women (Table 1, Figure 3). Although the number of breast cancer cases increases with higher socioeconomic status (SES), the survival rate consistently decreases with lower SES (Table 1, Figure 4). The majority of breast cancers are diagnosed at the earlier stages* (Table 1). These women have the highest survival rates from breast cancer (Table 1, Figure 5). Although late stage* tumors account for only 6% of AYA breast cancers diagnosed, these tumors result in substantially lower survival rates (Table 1, Figure 5).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, BREAST CANCER, LOS ANGELES COUNTY, 1988-2014

Breast Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	23	8,835	<10	124	3,251	5,484	1,211	1,217	2,952	3,274	205	1,872	2,004	1,766	1,720	1,438	59	4,202	3,885	528	244
Percent of Cases	0.3%	99.7%	—	1.4%	36.7%	61.9%	13.7%	13.7%	33.3%	37.0%	2.3%	21.1%	22.6%	19.9%	19.4%	16.2%	0.7%	47.4%	43.9%	6.0%	2.8%
1-year survival	95.5%	96.3%	—	97.5%	96.0%	96.5%	98.4%	92.6%	95.4%	97.5%	98.9%	98.5%	97.1%	96.2%	94.7%	94.2%	—	99.3%	97.0%	68.7%	92.3%
3-year survival	90.4%	85.4%	—	78.4%	82.9%	87.0%	90.7%	75.7%	82.3%	89.4%	94.5%	91.3%	88.0%	85.4%	80.2%	80.0%	—	95.3%	82.4%	33.0%	72.7%
5-year survival	84.4%	77.9%	—	67.9%	74.9%	79.9%	84.6%	66.4%	74.2%	82.5%	88.6%	84.6%	82.3%	77.3%	72.4%	70.0%	—	91.4%	72.0%	20.1%	62.4%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, BREAST CANCER, LOS ANGELES COUNTY, 1988-2014

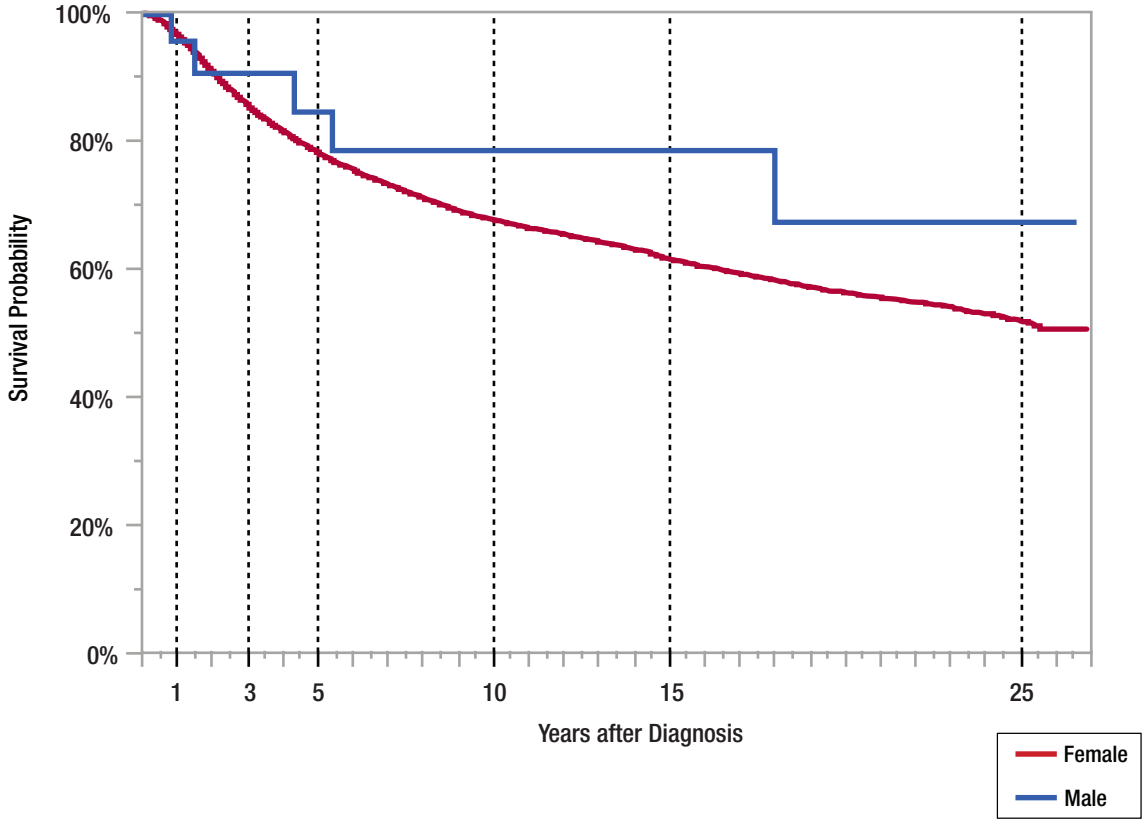


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, BREAST CANCER, LOS ANGELES COUNTY, 1988-2014

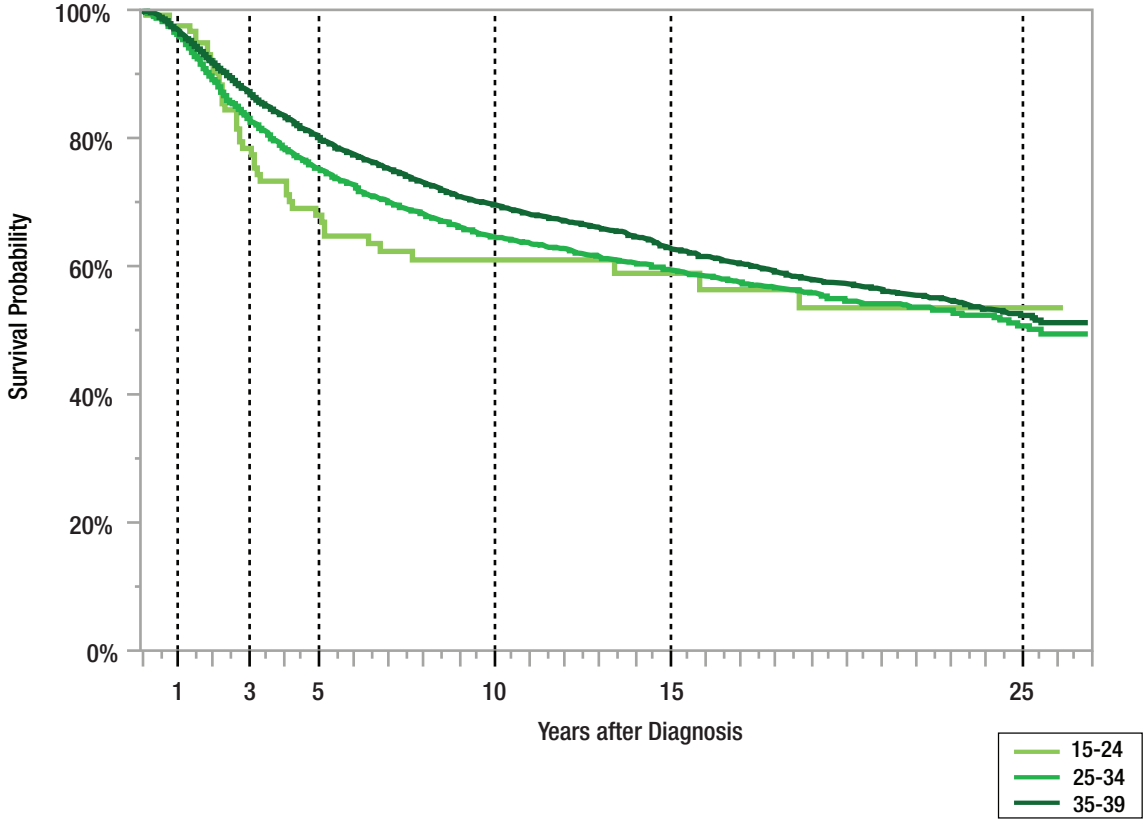


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, BREAST CANCER, LOS ANGELES COUNTY, 1988-2014

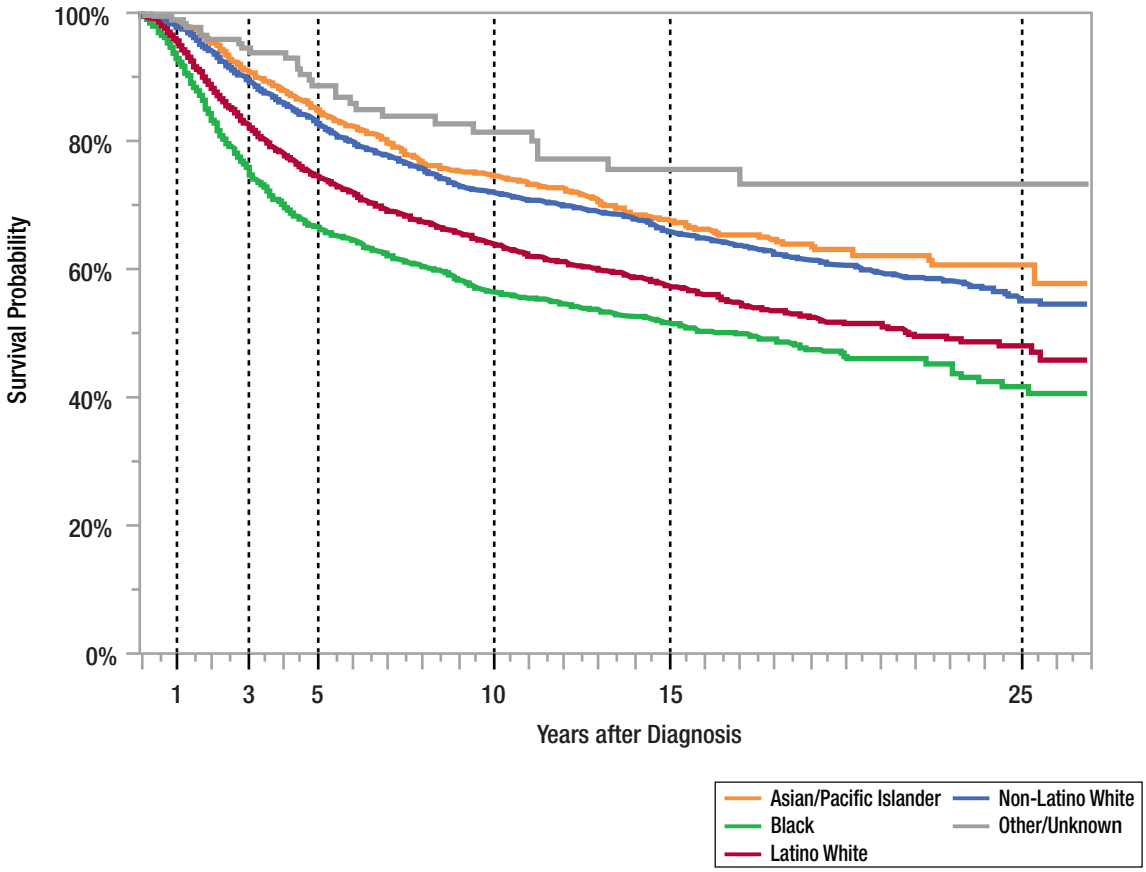


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, BREAST CANCER, LOS ANGELES COUNTY, 1988-2014

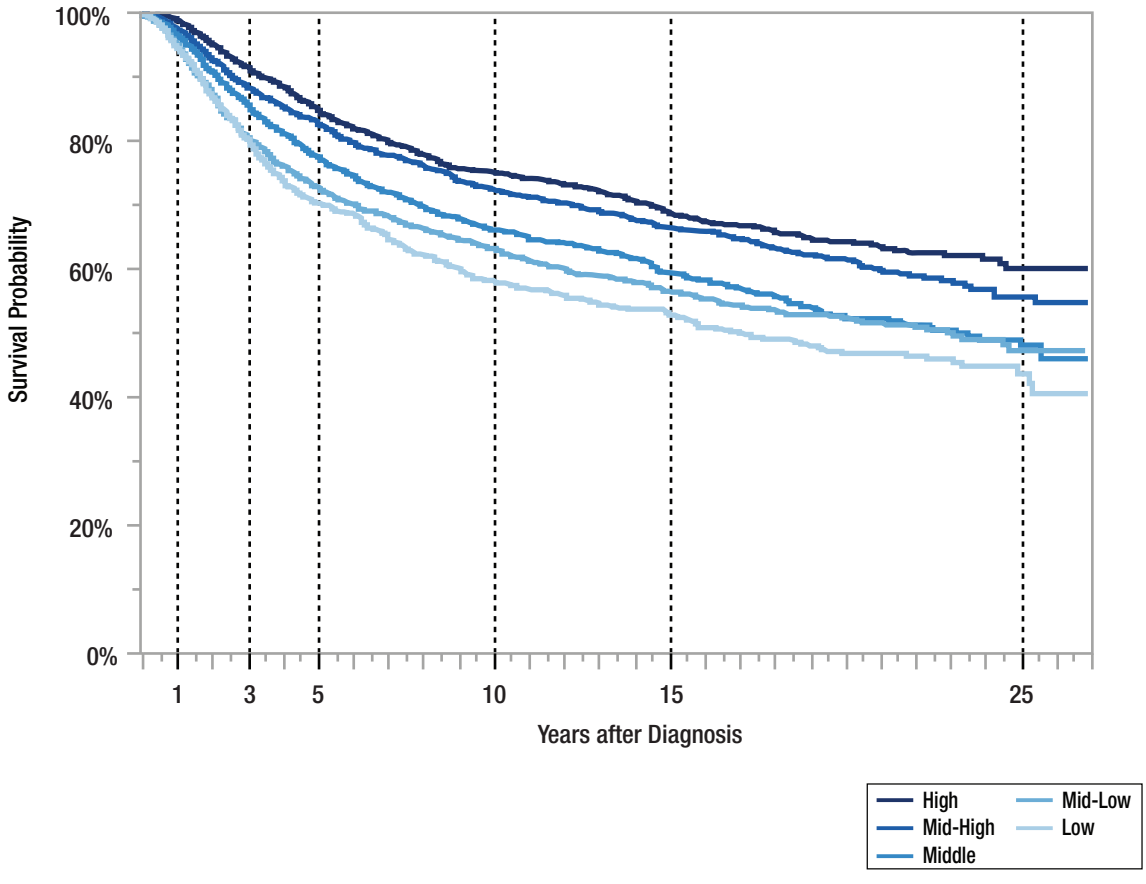
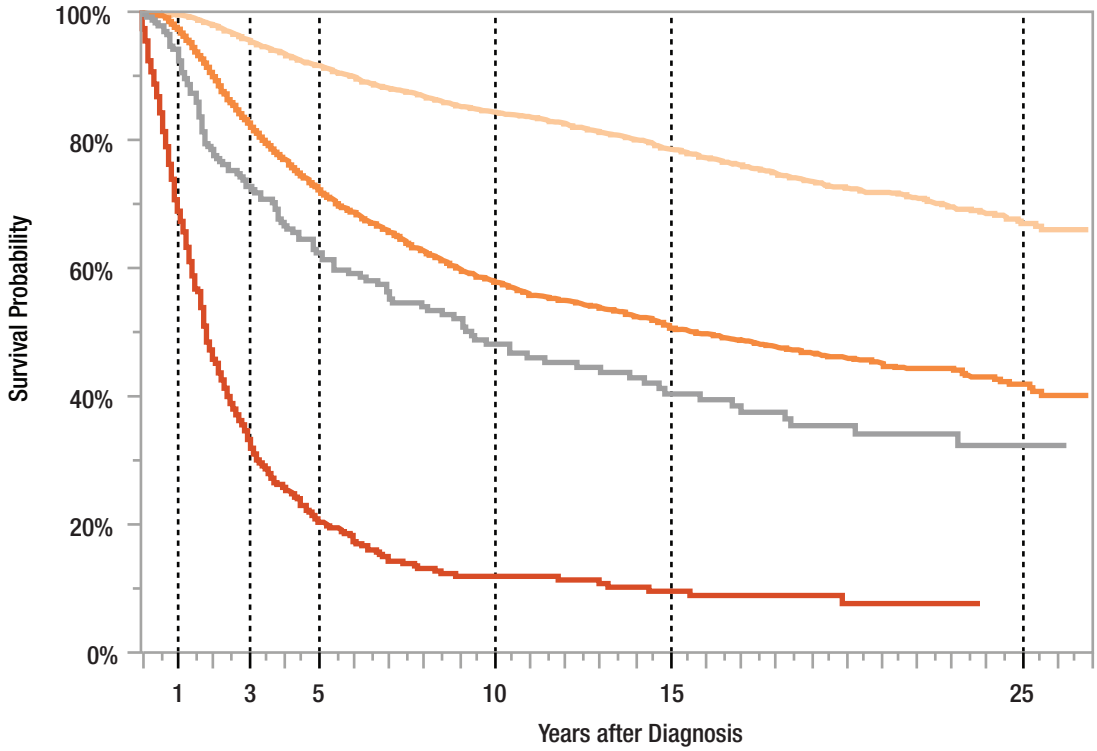


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, BREAST CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

CERVIX

Loraine Escobedo, PhD
Laurie Brunette, MD

BACKGROUND

Cervical cancer starts in the lower part of the uterus that connects to the vagina or birth canal. It is the 4th most common cancer among women in the world; less developed countries carry much of the burden. Because of limited screening (with a Pap test), most women who develop cervical cancer in these countries are diagnosed at later stages* and do not survive well.

Infection with human papillomavirus (HPV) is the most important cause of cervical cancer. Other factors that may influence the risk of progression from HPV infection to cervical cancer include oral contraceptive use, cigarette smoking, diet, cervical injury, HIV infection and other sexually transmitted diseases, number of children, obesity, multiple sexual partners, younger age at first sexual intercourse, hormones, medications, genetic factors and suppressed immune system.

In the U.S., cervical cancer is most commonly diagnosed among women aged 35 to 44 and is most fatal among women aged 45 to 54. Incidence and death rates have been declining in the last decade because of prevention programs. However, rates remain high among certain racial/ethnic minorities, new immigrants and the socioeconomically deprived, potentially due to lack of health care and knowledge about screening and prevention. Vaccines that prevent HPV infections have been approved for use among adolescent boys and girls, and may substantially reduce cervical cancer if widely used.

AYA SURVIVAL IN LOS ANGELES COUNTY

For adolescents and young adults (AYA) in Los Angeles County, there were a total of 3,781 cervical cancer cases diagnosed during 1988-2014 (Table 1). The highest numbers are among Latina whites (54%), 25 to 34 year-olds (50%), low socioeconomic status (SES) group (31%) and cancers diagnosed at a localized stage* (65%).

The 1-, 3- and 5-year survival rates are 93%, 82% and 79%, respectively (Table 1, Figure 1). Blacks consistently have the lowest survival rates, followed by Asian/Pacific Islanders, Latina whites, and non- Latina whites (Figure 3). Survival at 1, 3, and 5 years after diagnosis is higher among non-Latina whites (93% at 1 year, 85% at 3 years, 82% at 5 years) than blacks (87% at 1 year, 69% at 3 years, 66% at 5 years) (Table 1, Figure 3).

Survival of cervical cancer is similar across all AYA age groups up to 3 years after diagnosis (Figure 2). However, survival beyond 5 years after diagnosis is lowest for women in the oldest age group (35-39 years old). The probability of surviving at each time point is markedly worse with lower SES (Figure 4).

Approximately 99%, 95% and 93% of women diagnosed at early stage* survive beyond 1, 3 and 5 years after diagnosis, respectively (Table 1, Figure 5). These percentages drop to 54%, 29% and 24%, respectively, if the cancer was diagnosed at late stage*. Survival at 5 years for women diagnosed at an early stage* is four times higher than women diagnosed at late stage* (93% vs. 24%).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, CERVICAL CANCER, LOS ANGELES COUNTY, 1988-2014

Cervical cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	—	3,781	—	152	1,880	1,749	258	356	2,047	1,019	101	448	589	648	910	1,154	32	2,455	938	211	177
Percent of Cases	—	100.0%	—	4.0%	49.7%	46.3%	6.8%	9.4%	54.1%	27.0%	2.7%	11.8%	15.6%	17.1%	24.1%	30.5%	0.8%	64.9%	24.8%	5.6%	4.7%
1-year survival	—	92.8%	—	91.8%	93.0%	92.7%	91.6%	86.9%	93.6%	93.4%	95.1%	96.1%	94.7%	93.4%	92.1%	90.7%	—	98.8%	86.6%	53.8%	89.2%
3-year survival	—	82.1%	—	83.2%	82.3%	81.7%	80.9%	69.4%	82.4%	85.4%	90.0%	88.6%	84.4%	82.2%	81.7%	78.3%	—	94.9%	62.4%	28.7%	71.1%
5-year survival	—	78.7%	—	81.7%	79.4%	77.6%	77.6%	65.9%	79.1%	82.2%	83.7%	86.1%	82.0%	78.5%	77.9%	74.5%	—	93.0%	55.9%	23.8%	64.5%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, CERVICAL CANCER, LOS ANGELES COUNTY, 1988-2014

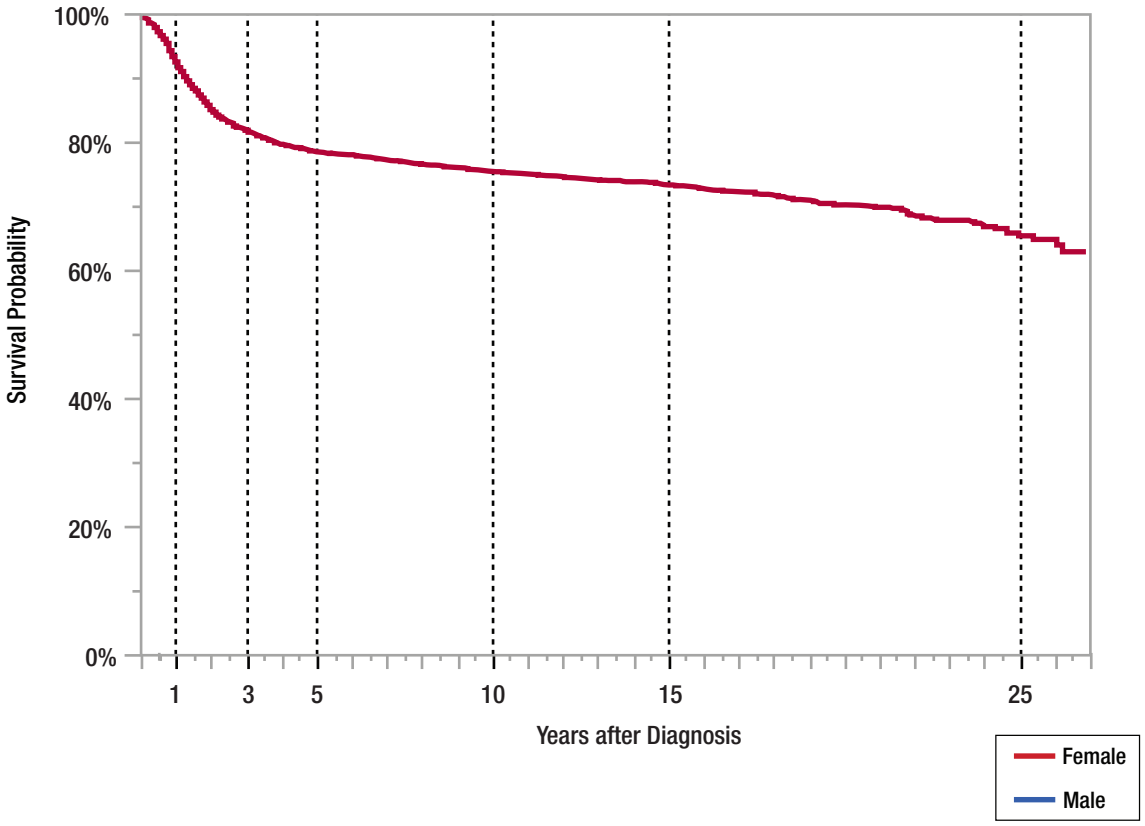


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, CERVICAL CANCER, LOS ANGELES COUNTY, 1988-2014

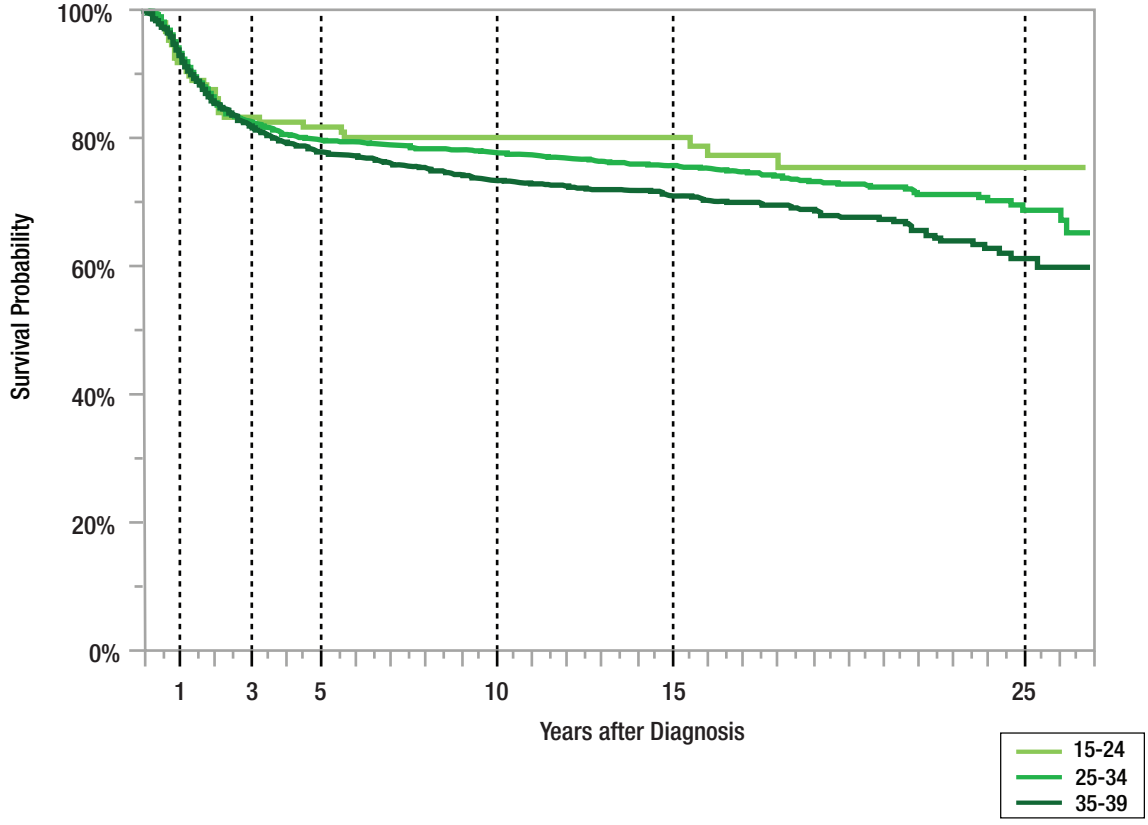


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, CERVICAL CANCER, LOS ANGELES COUNTY, 1988-2014

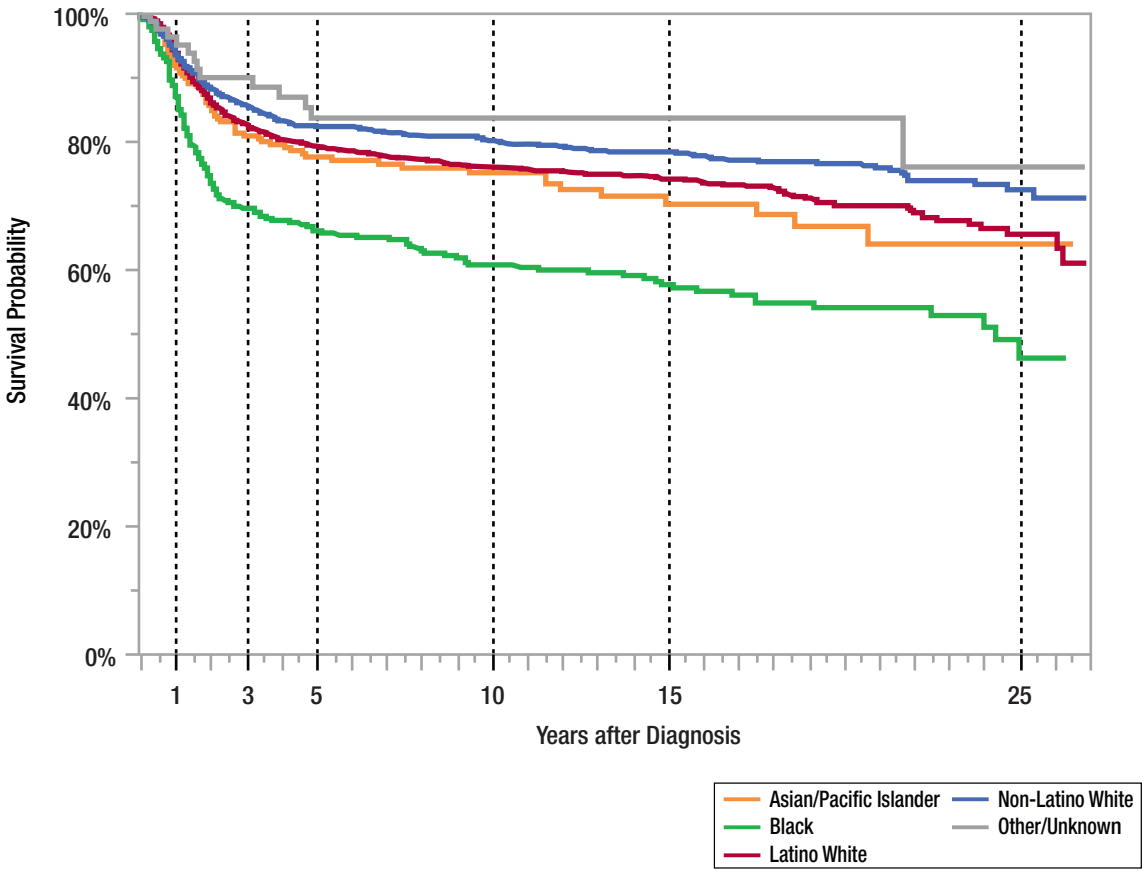


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, CERVICAL CANCER, LOS ANGELES COUNTY, 1988-2014

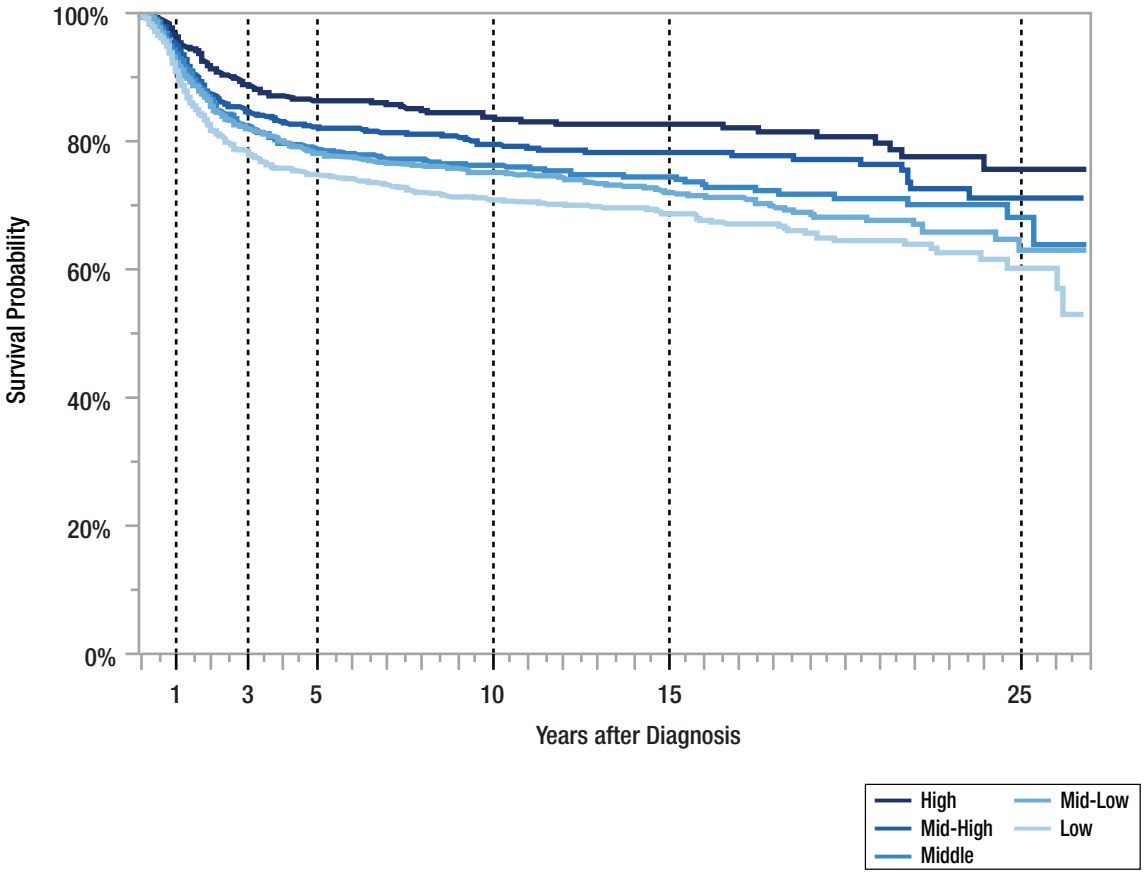
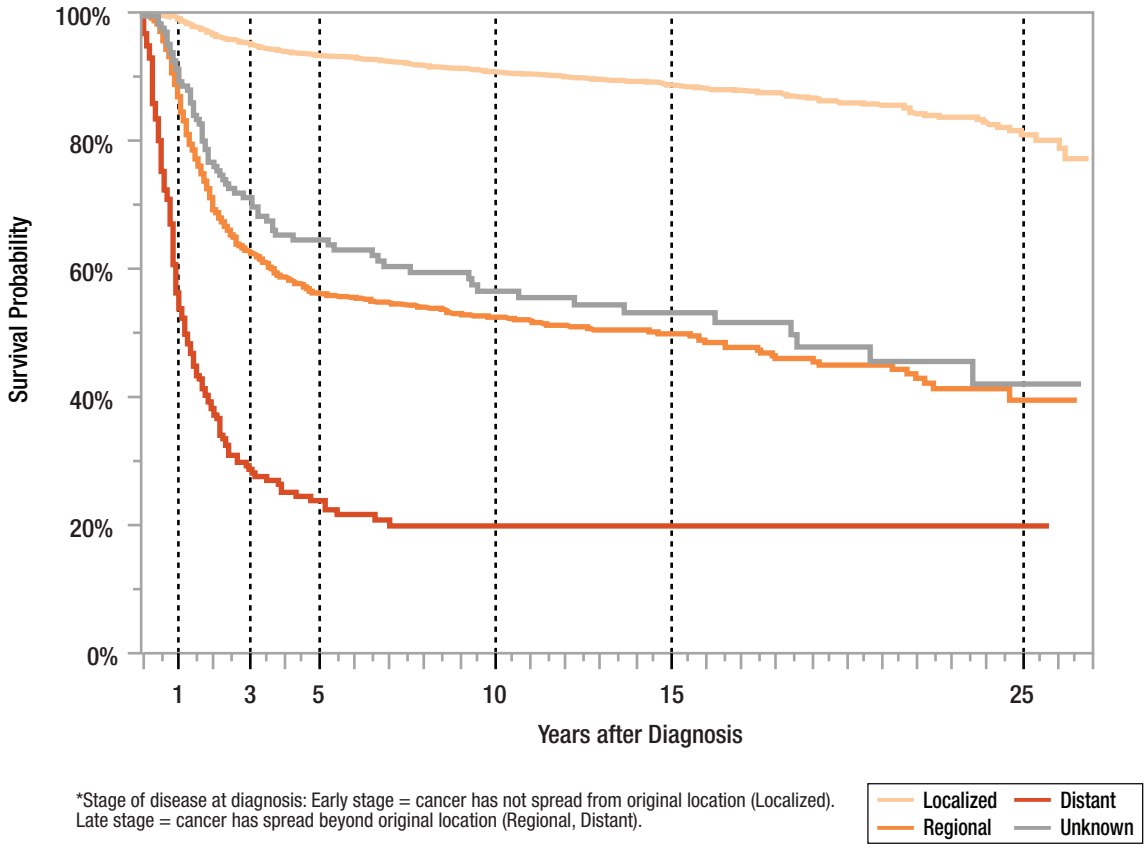


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, CERVICAL CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

COLON AND RECTUM

Mariana C. Stern, PhD
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BACKGROUND

While colorectal cancer is the third most common cancer in the U.S., it happens most frequently (90%) in adults over 50 years old, much less (6%) in adolescents and young adults (AYAs). It ranks among the five most common cancers affecting AYA men, and among the top ten affecting AYA women. Colorectal cancer incidence rates have been declining for the general population, mostly due to the introduction of screening for individuals 50 and older. However, for unclear reasons, colorectal cancer diagnosis rates in AYAs have been rising. In addition, while death rates due to colorectal cancer in the general population have been declining, death rates in AYAs have been rising. Compared to other AYA cancers, colorectal cancer ranks second for death rate in AYA men, and fourth for death rate in AYA women.

Several factors increase the risk of colorectal cancer. Having a family history of colorectal cancer, having certain genetic disorders such as Familial Adenomatous Polyposis or Lynch syndrome, or being black or Ashkenazi Jew increase the risk of colorectal cancer. Being physically active, maintaining a healthy weight, not smoking, not excessively using alcohol, and eating a diet high in fruits and vegetables and low in red and processed meat may protect against colorectal cancer. It is estimated that half of colorectal cancers could be prevented if everyone followed these recommendations. While not proven, it is suspected that lack of physical activity and poor diet may be contributing to the increasing rates of colorectal cancer in AYAs.

When tumors are found at early stage* (about 40% are caught early), they are typically treated with surgery, sometimes followed by chemotherapy. Radiation is generally used to treat locally advanced rectal cancers. For tumors that are late stage* (about 20% of those diagnosed), chemotherapy, in combination with targeted drugs, are standard therapies. In selected patients, additional surgeries to remove the colon cancer and distant metastases can result in cure. Five years after diagnosis, 90% of cases with early stage* disease survive. Among those with late stage* disease, only ~14% survive.

AYA SURVIVAL IN LOS ANGELES COUNTY

In Los Angeles County during 1988-2014, 2,645 AYAs were diagnosed with colon or rectal cancer (1,435 men and 1,209 women). More than half (55%) are 35-39 years old, with 39% 25-34 years old and 6% 15-24 years old (Table 1). Latino white AYAs have the highest number of colorectal cancer diagnoses (38%), followed by non-Latino white (34%), Asian/Pacific Islander (13%), black (13%) and other (3%) (Table 1). The numbers of diagnosed cases are fairly equally distributed across socioeconomic status (SES), with slightly fewer cases in high and low SES groups (Table 1). More cases are diagnosed as regional disease (38%), than either early stage* (31%) or late stage* (26%) (Table 1).

There are no strong differences in survival rates between men and women (5-year survival 59% men and 62% women) (Table 1, Figure 1). Survival rates are very similar across racial/ethnic groups (5-year survival ~60%) (Table 1, Figure 3). Survival rates are better for older AYAs than the youngest AYAs. The 5-year survival rates are 62% for 35-39 years old and 60% for 25-34 years old, as compared to 51% for 15-24 years old (Table 1, Figure 2). Survival rates decrease with decreasing SES (5-year survival of 67% for high SES versus 52% for low SES) (Table 1, Figure 4). Similar to older adults and the U.S. as a whole, early stage* tumors have the highest survival (5-year survival 91%) and late stage* have the lowest survival (14%) (Table 1, Figure 5).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, COLORECTAL CANCER, LOS ANGELES COUNTY, 1988-2014

Colorectal Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	1,435	1,209	<10	155	1,041	1,449	335	332	991	907	80	435	553	540	606	497	14	807	998	692	148
Percent of Cases	54.3%	45.7%	—	5.9%	39.4%	54.8%	12.7%	12.6%	37.5%	34.3%	3.0%	16.4%	20.9%	20.4%	22.9%	18.8%	0.5%	30.5%	37.7%	26.2%	5.6%
1-year survival	84.5%	87.5%	—	77.6%	85.6%	87.0%	87.8%	85.0%	87.0%	83.9%	91.5%	87.5%	88.6%	86.1%	85.7%	82.1%	—	97.7%	94.0%	62.4%	77.1%
3-year survival	66.5%	69.3%	—	56.3%	67.4%	69.3%	68.5%	67.2%	67.1%	67.2%	82.8%	73.4%	70.8%	65.9%	69.7%	59.2%	—	93.8%	76.9%	25.7%	60.1%
5-year survival	58.7%	62.2%	—	50.7%	59.8%	61.8%	60.6%	57.7%	59.2%	60.7%	81.0%	67.0%	64.4%	58.8%	60.2%	51.8%	—	91.0%	67.9%	14.2%	54.5%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, COLORECTAL CANCER, LOS ANGELES COUNTY, 1988-2014

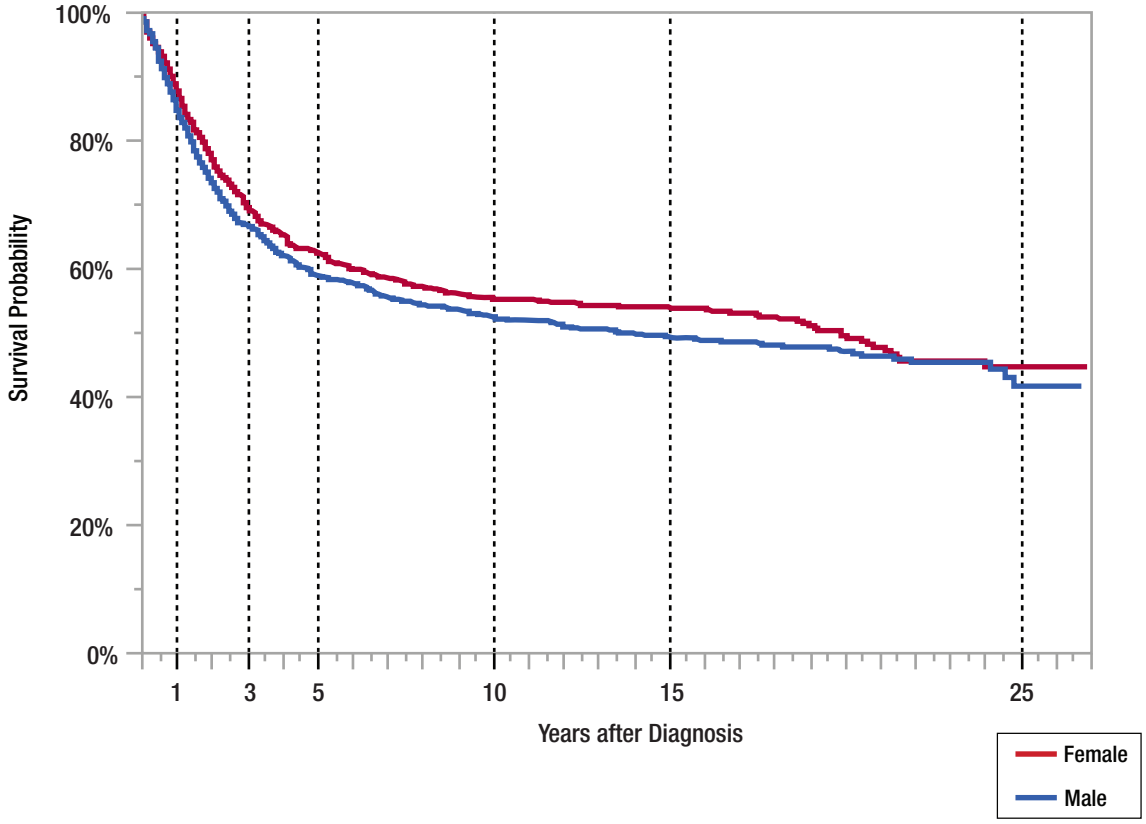


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, COLORECTAL CANCER, LOS ANGELES COUNTY, 1988-2014

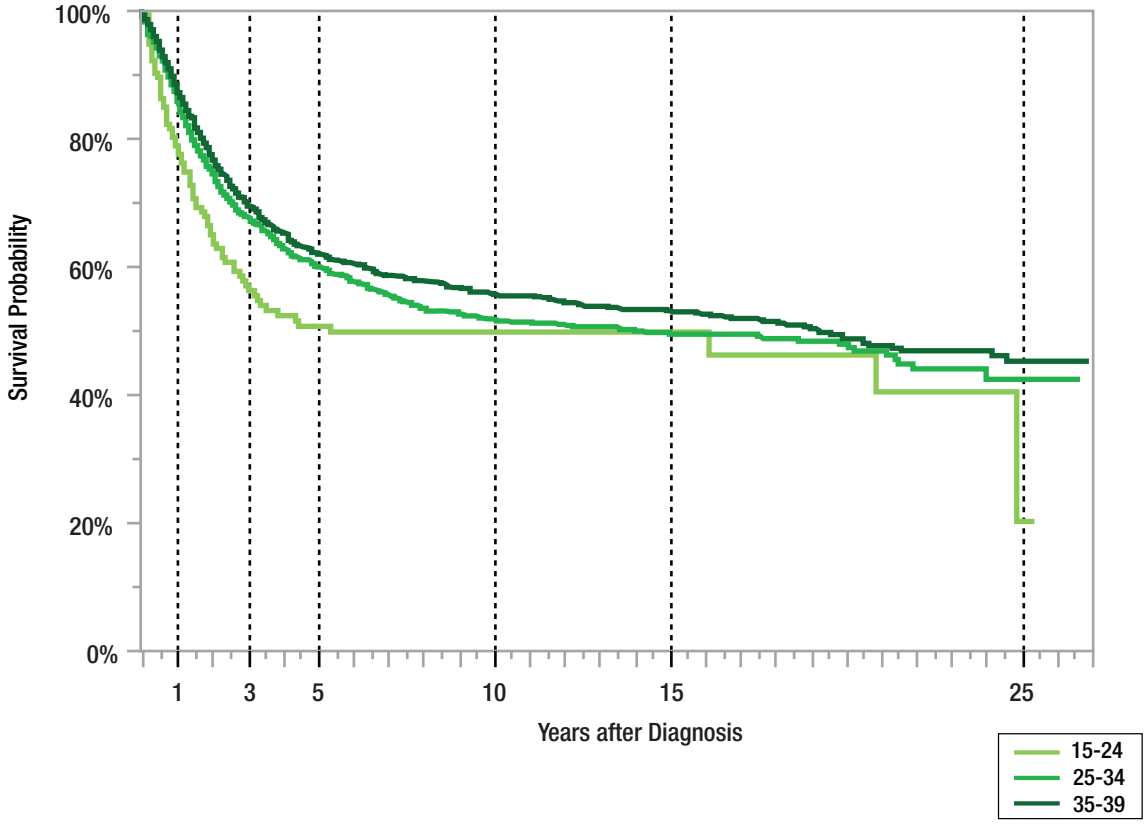


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, COLORECTAL CANCER, LOS ANGELES COUNTY, 1988-2014

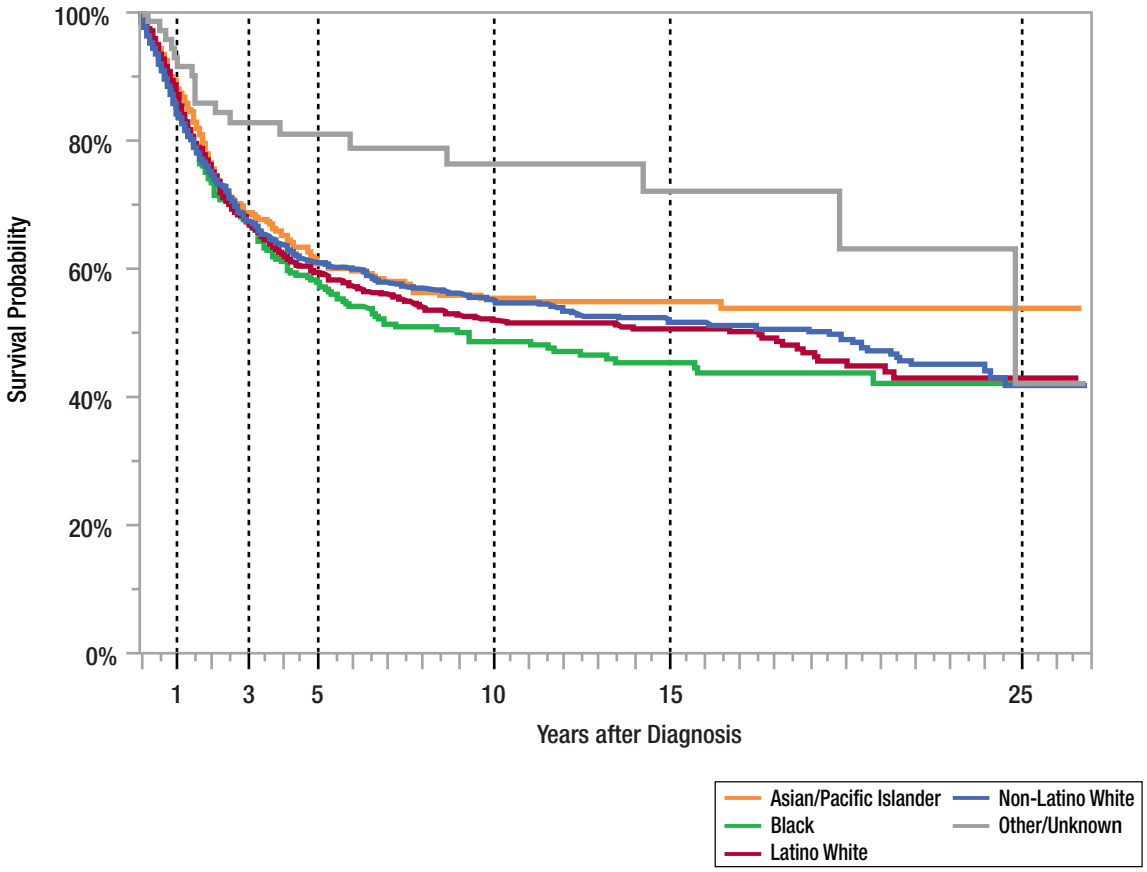


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, COLORECTAL CANCER, LOS ANGELES COUNTY, 1988-2014

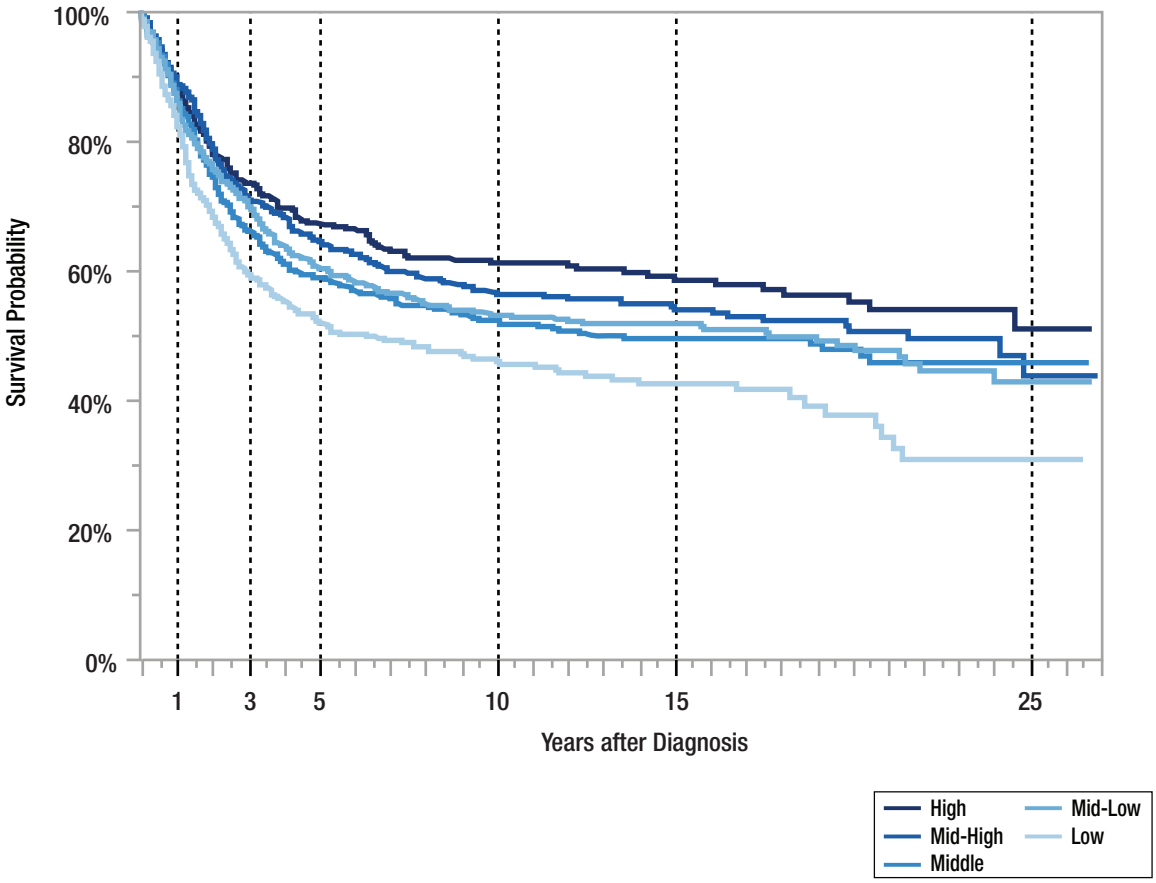
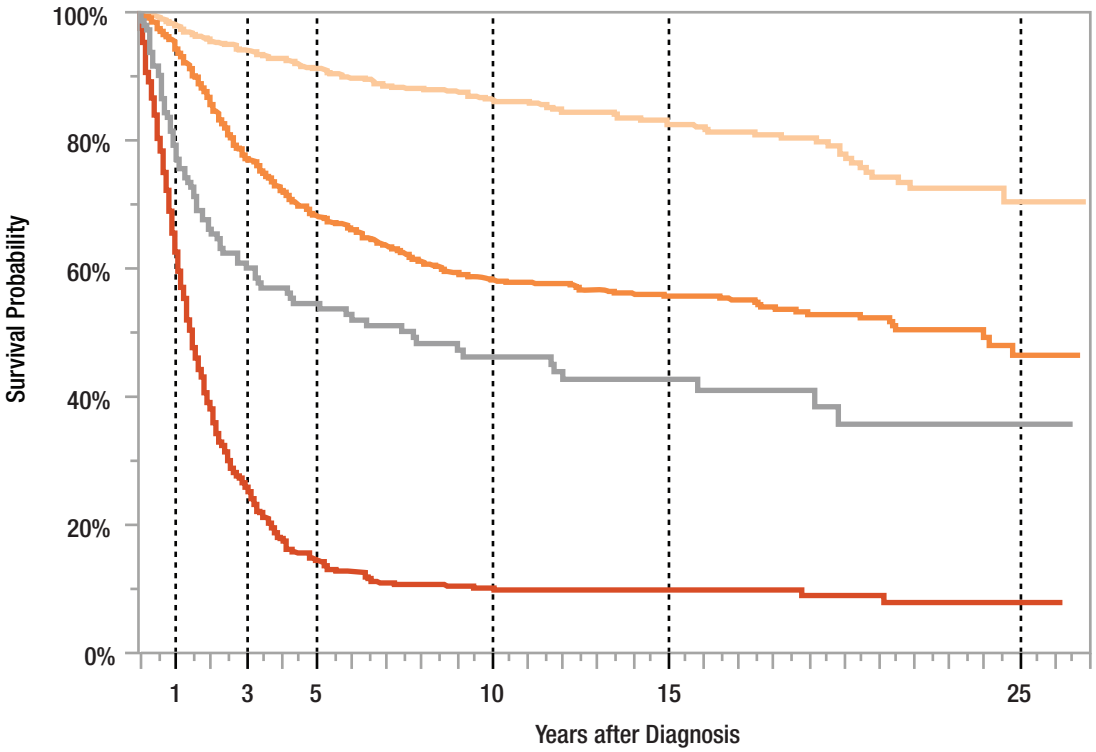


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, COLORECTAL CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

KAPOSI SARCOMA

Ann Hamilton, PhD
Anil Tulpule, MD

BACKGROUND

There are four forms of Kaposi Sarcoma (KS). AIDS-associated KS is the form that occurs among the Los Angeles adolescent and young adult (AYA) population. All forms of KS are related to infection with the Kaposi sarcoma-associated herpesvirus (KSHV, a.k.a. HHV-8) along with other factors. The incidence of KS among the AYA population parallels HIV/AIDS affecting predominantly males, with higher incidence in the early years of the AIDS epidemic, followed by a steep decline after combination antiretroviral therapy or cART, was introduced in 1996. It was not until the AIDS epidemic that KS was seen in the AYA population. While current treatments are not able to cure KS, treatment with cART has not only reduced incidence of the disease, but also has greatly improved survival.

Use of cART has resulted in a dramatic decline in the incidence of KS among AYAs in Los Angeles County, as in other areas with access to cART. For early stage* disease, in addition to cART, treatments include surgery, radiation, Panretin gel, cryotherapy, chemotherapy and laser therapy. Patients with late stage*, widespread, rapidly progressive disease require systemic chemotherapy. HIV patients with KS (even when treated with cART) have an increased risk of death compared to HIV patients without KS. In addition, survivors of both KS and HIV have a lower immune response to cART than HIV infected individuals without KS.

AYA SURVIVAL IN LOS ANGELES COUNTY

Survival has increased between the pre-cART (1988-1995) and post-cART (1996-2014) eras. Among males (99% of cases) the probability of surviving beyond 1-year was 57% in the pre-cART era vs. 77% in the post-cART era (Tables 1). Even more dramatic improvement is seen for survival beyond 5-year which has increased from 13% to 61%. As shown in Figures 1A and 1B, there is no substantial difference in survival by sex.

There are very few cases in the 15-24 age group. However, although survival improved in the post-cART era within each age group, no significant differences in survival are seen between age groups during either time period (Figure 2A, 2B).

As would be expected, survival is associated with stage* at diagnosis (Figures 5A, 5B). For those with early stage*, survival has increased dramatically between the pre-cART and post-cART eras. Improvements are also seen in the other stages*. However, for the late stage*, significant improvement was not seen until 5 years from diagnosis, with nearly a third surviving beyond 5 years in the post-cART era compared to less than 7% in the pre-cART era. There are differences in survival by race/ethnicity, especially in the post-cART era (Figure 3A, 3B). Very little difference in survival by race/ethnicity was seen before cART. Survival beyond 5 years during that time period ranged from 9% among Asian/Pacific Islanders to 15% among Latino whites. However in the post-cART era, 77% of Asian/Pacific Islanders survive beyond 5 years compared to 53% of blacks, 58% of Latino whites, and 63% of non-Latino whites.

Finally, survival is positively related to socioeconomic status (SES), which is seen predominantly in the post-cART era (Figures 4A, 4B). For example, among those in the high SES group, 87% survive beyond one year compared to 71% in the low SES group in the post-cART era. For surviving beyond 5 years, those in the high SES group have a survival of 77% vs. 53% among those in the low SES group in the post-cART era (compared to 14% vs 13% in the pre-cART era).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, KAPOSI SARCOMA, LOS ANGELES COUNTY, 1988-2014

Kaposi Sarcoma	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Year 1988 - Year 1995																					
Number of Cases	2,916	27	<10	83	1,751	1,114	35	336	880	1,585	112	329	684	669	674	470	122	439	33	1,129	1,347
Percent of Cases	98.9%	0.9%	—	2.8%	59.4%	37.8%	1.2%	11.4%	29.9%	53.8%	3.8%	11.2%	23.2%	22.7%	22.9%	15.9%	4.1%	14.9%	1.1%	38.3%	45.7%
1-year survival	57.2%	55.6%	—	65.4%	57.0%	56.8%	45.7%	46.7%	56.7%	60.0%	54.9%	59.6%	59.1%	59.4%	55.7%	49.9%	—	58.4%	57.6%	50.7%	62.3%
3-year survival	19.2%	29.6%	—	31.4%	18.8%	19.2%	17.1%	18.2%	20.5%	18.2%	34.7%	21.2%	18.1%	17.3%	19.3%	19.6%	—	20.8%	21.2%	11.0%	25.8%
5-year survival	13.2%	25.9%	—	25.9%	12.4%	13.8%	8.6%	12.5%	14.5%	12.0%	31.8%	14.4%	11.6%	12.9%	12.5%	13.2%	—	13.4%	15.2%	6.7%	18.7%
Year 1996 -Year 2014																					
Number of Cases	965	19	<10	38	530	418	27	171	439	283	66	94	212	194	235	228	23	243	149	12	582
Percent of Cases	97.9%	1.9%	—	3.9%	53.8%	42.4%	2.7%	17.3%	44.5%	28.7%	6.7%	9.5%	21.5%	19.7%	23.8%	23.1%	2.3%	24.6%	15.1%	1.2%	59.0%
1-year survival	77.0%	68.4%	—	71.1%	76.0%	78.6%	85.0%	70.5%	75.1%	79.6%	92.9%	86.9%	78.8%	77.2%	76.2%	70.7%	—	79.1%	75.2%	48.6%	77.1%
3-year survival	65.8%	63.2%	—	54.5%	65.1%	67.8%	76.7%	57.3%	64.1%	68.1%	88.9%	79.9%	67.2%	65.7%	64.8%	58.8%	—	71.7%	64.8%	36.5%	64.4%
5-year survival	61.0%	52.6%	—	46.7%	59.5%	63.5%	76.7%	53.3%	58.3%	62.6%	86.7%	77.4%	63.5%	57.7%	61.2%	52.6%	—	68.6%	59.4%	36.5%	58.7%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, KAPOSI SARCOMA, LOS ANGELES COUNTY, 1988-2014

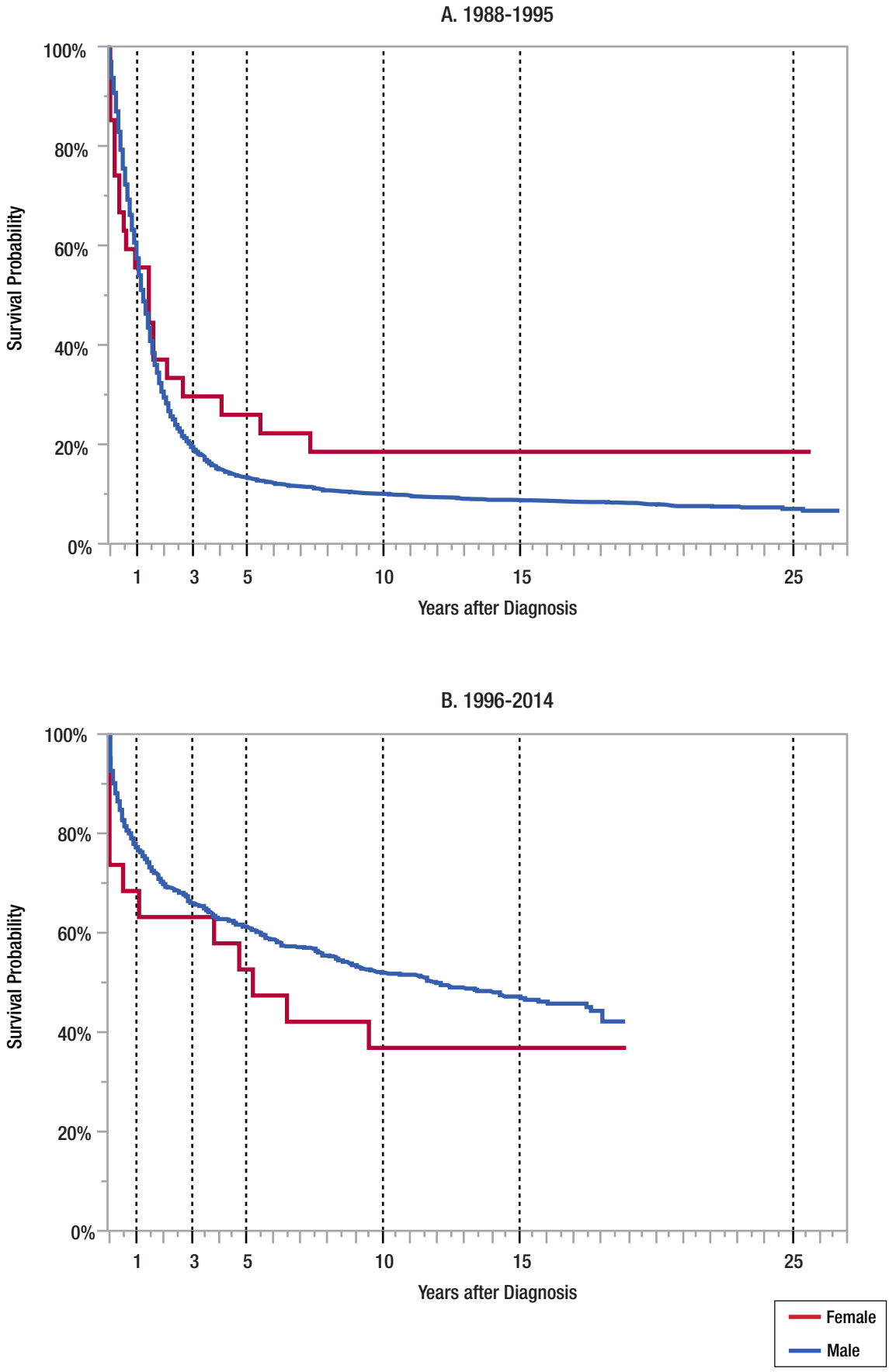


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, KAPOSI SARCOMA, LOS ANGELES COUNTY, 1988-2014

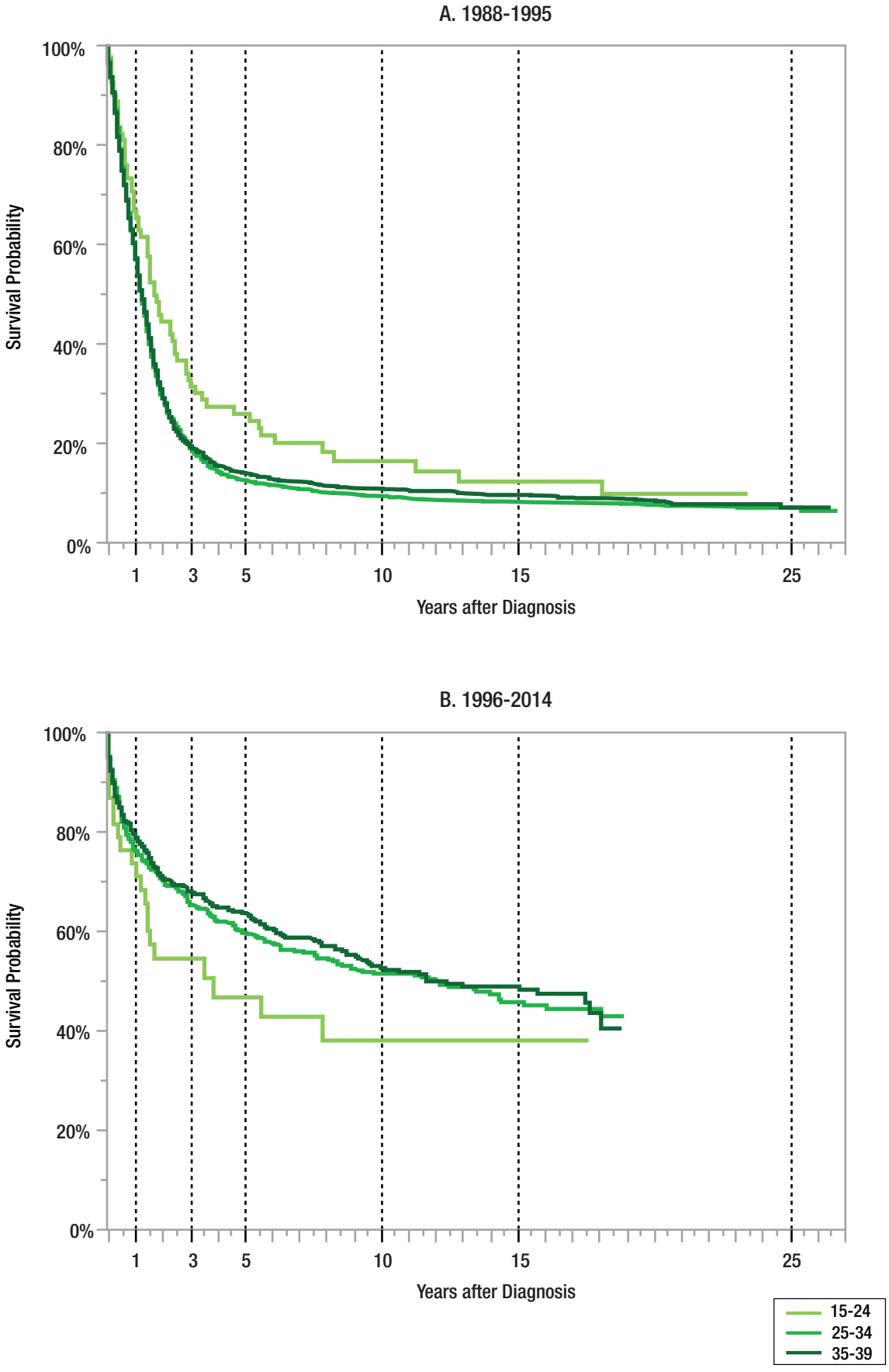


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, KAPOSI SARCOMA, LOS ANGELES COUNTY, 1988-2014

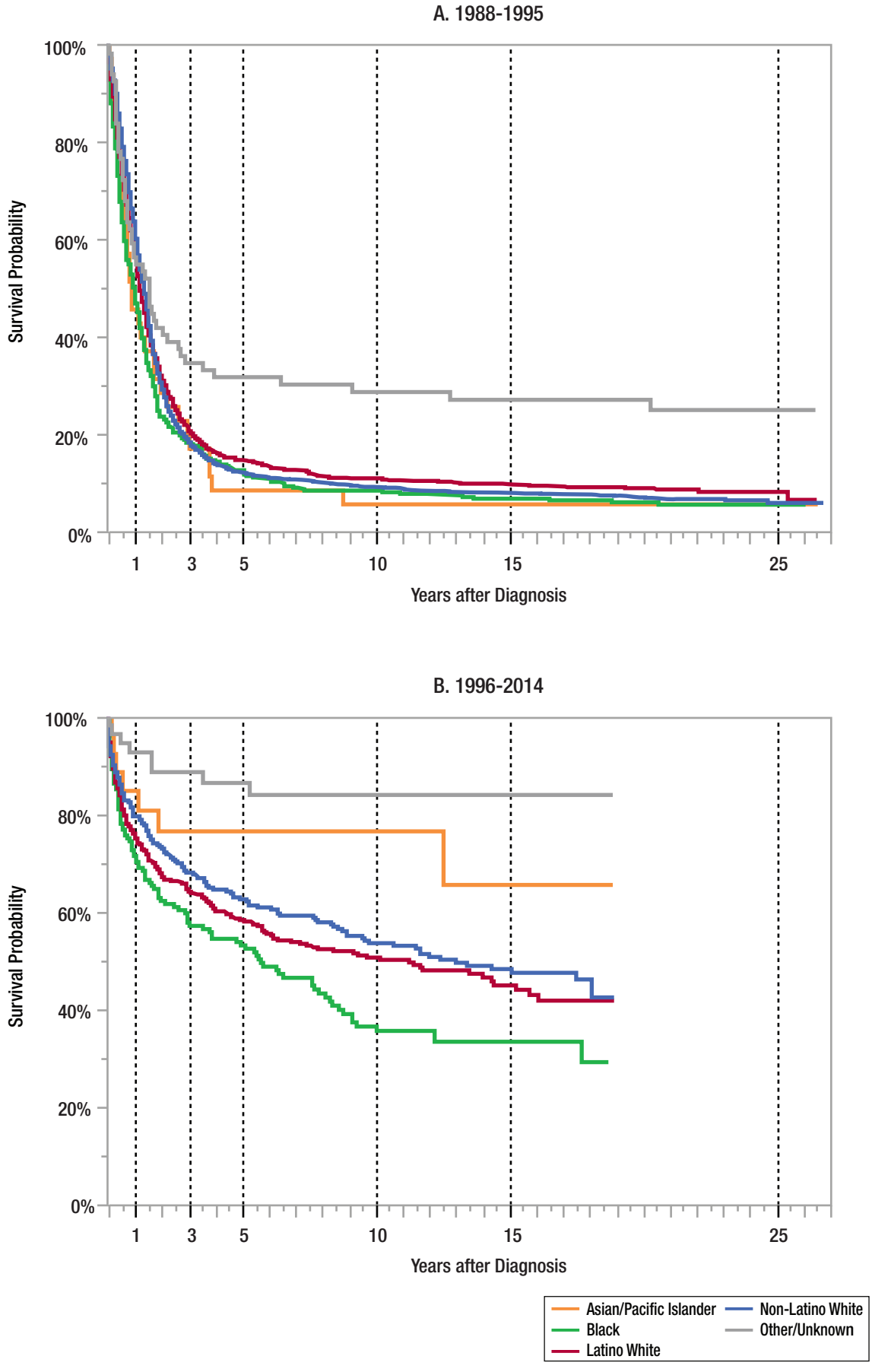


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, KAPOSI SARCOMA, LOS ANGELES COUNTY, 1988-2014

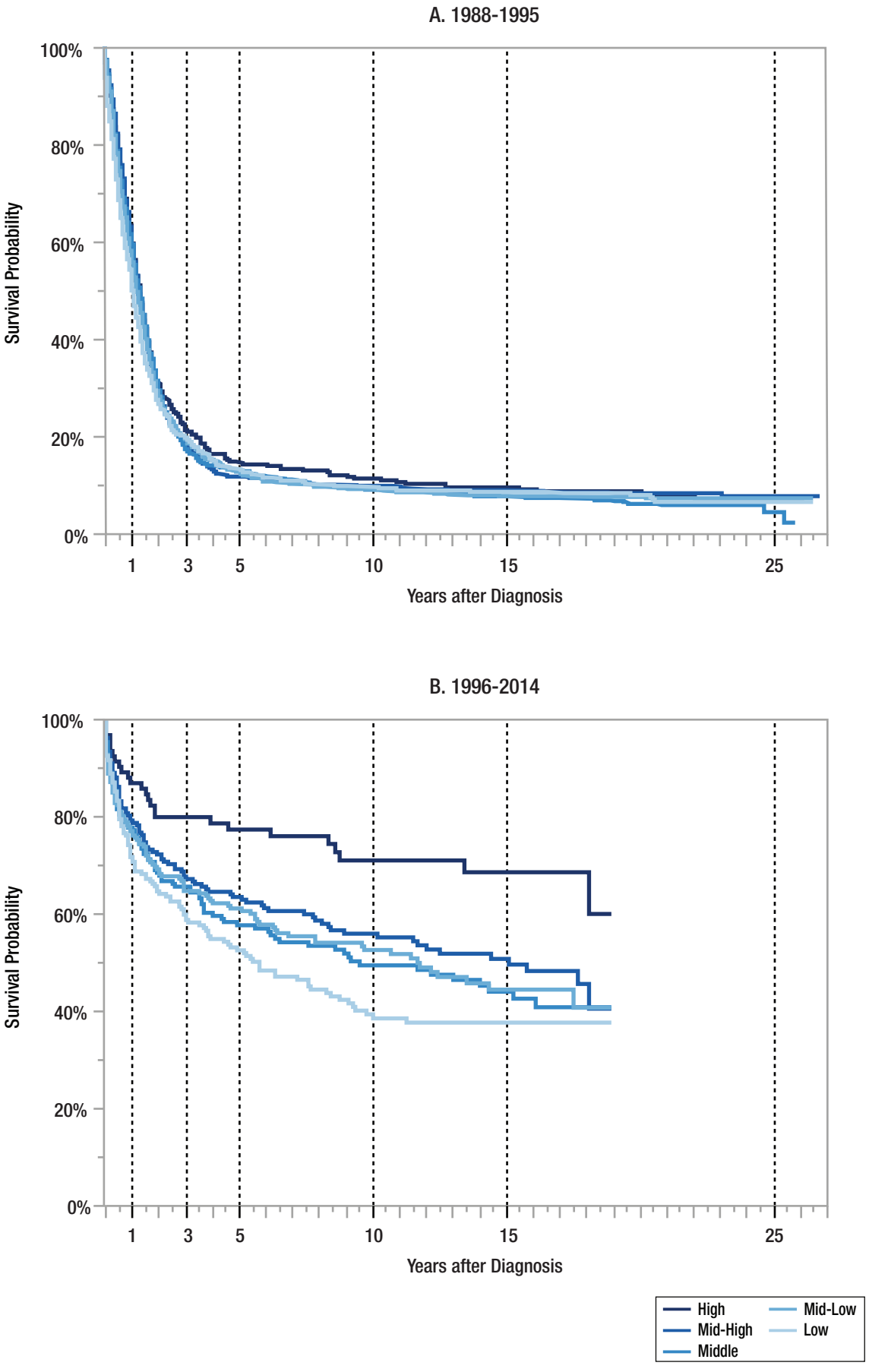
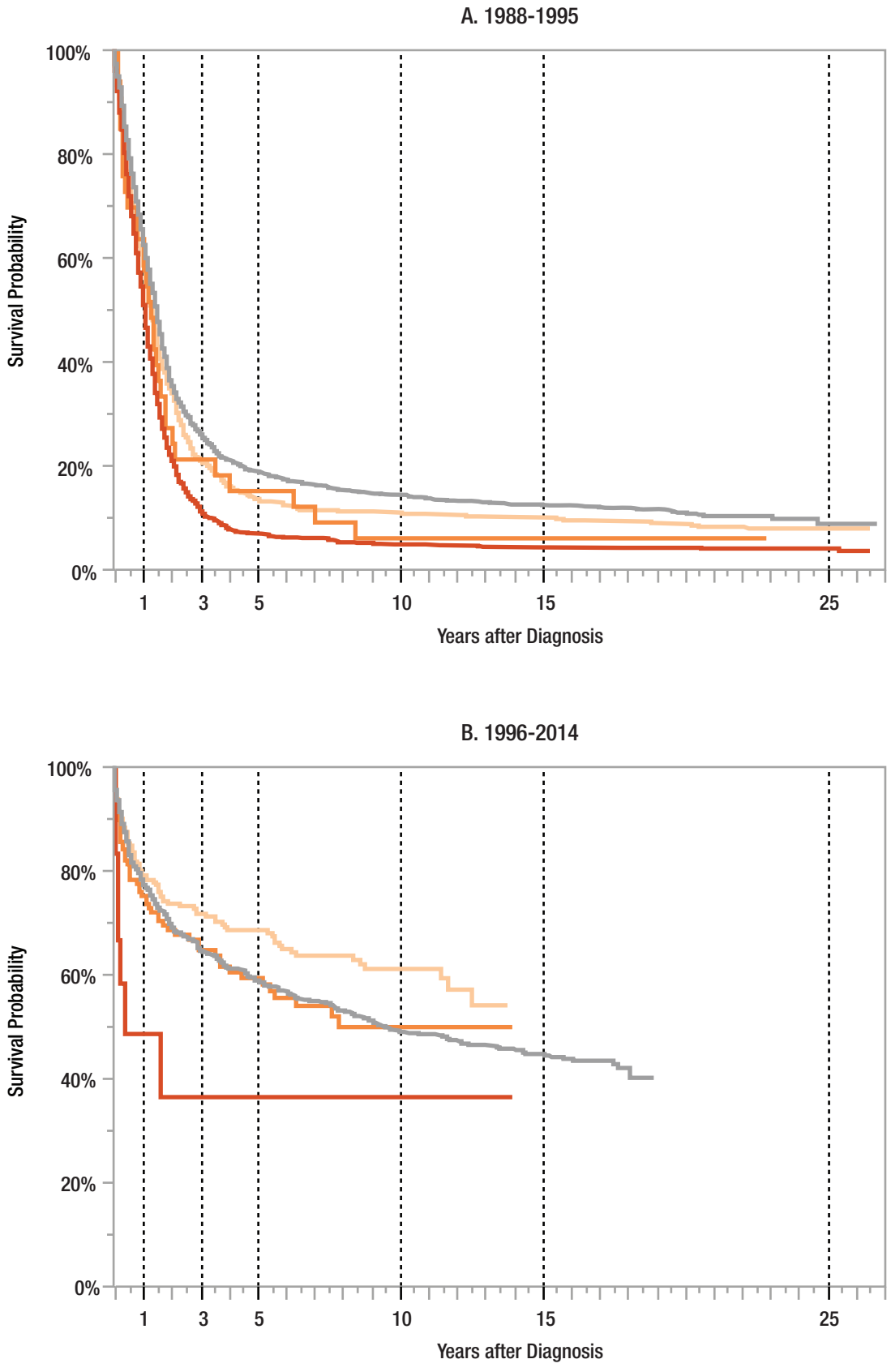


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, KAPOSI SARCOMA, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

KIDNEY

Recinda L. Sherman, PhD
Diana Moke, MD
Tanya Dorff, MD

BACKGROUND

The kidneys are a pair of bean-shaped organs, four to five inches long in adults, located in the back of the abdomen. The role of the kidneys is to filter the blood to remove waste, help control blood pressure, and control the body's balance of fluid and electrolytes. As the kidneys filter blood, they make urine, which is collected in an area of the kidney called the renal pelvis, is then drained into the bladder. Only one kidney is needed to function. Kidney cancer accounts for about 5% of all cancers among adolescents and young adults (AYAs), and renal cell carcinoma is the most common type (90%). Since other forms of kidney cancer are rare in the AYA population, we will only be discussing renal cell carcinoma here.

Some important risk factors for kidney cancer include cigarette smoking, obesity, high blood pressure, advanced kidney disease, certain workplace exposures, family history of kidney cancer, as well as some genetic syndromes and certain birth defects. The rate of new kidney cancer has been rising since the 1990's in the U.S., while decreasing or remaining the same worldwide. Because the increase in rates is mostly seen in early stage*, it is likely that newer scanning technology is more sensitive in picking up early cases than there being an actual rise in the risk of kidney cancer.

Standard treatment for kidney cancer includes active surveillance, surgery, ablation, radiation, immunotherapy, and/or targeted drug therapy. The type of treatment depends on how far the cancer has spread at diagnosis (i.e., stage* of disease) as well as overall health of the patient.

AYA SURVIVAL IN LOS ANGELES COUNTY

A total of 942 cases of kidney cancer were diagnosed among Los Angeles County's AYA residents during 1988-2014, with the majority (74%) diagnosed at early stage* (Table 1). There are more cases of kidney cancer among men (59%) than women (41%), and kidney cancer is more common among whites (47% Latino whites and 32% non-Latino whites) than non-whites (8% Asian/Pacific Islander and 13% black) (Table 1). Among AYAs, kidney cancer is more common with older age; 7% of the cases diagnosed among 15-24 year olds, 40% among 25-24 year olds, and 54% among the 34-39 year olds (Table 1). The percent of cases is similar across socioeconomic status (SES) groups, although those of high SES have slightly fewer cases (16%) (Table 1).

There are distinct AYA survival patterns for kidney cancers by sex, age, race/ethnicity, SES, and stage* of disease (Table 1, Figures 1-5). Women have higher survival than men: 85% 5-year survival for women and 76% for men (Table 1, Figure 1). For at least 10 years after diagnosis, the youngest AYAs (15-24 years old) have the lowest survival rate among all AYAs (Figure 2). Five-year survival is lowest for blacks (64%) as compared to other race/ethnicities: 82% for Asian/Pacific Islanders, 83% for Latino whites, and 81% for non-Latino whites (Table 1, Figure 3). In general, 5-year survival decreases with increasing poverty: 87% for patients of high SES and 76% for those of low SES (Table 1, Figure 4). The most important differences in survival are by stage*, as 5-year survival rate decreases dramatically with later stages*: 94% for early stage*, 72% for regional stage*, and 9% for late stage* (Table 1, Figure 5).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, KIDNEY CANCER, LOS ANGELES COUNTY, 1988-2014

Kidney Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	556	386	—	66	372	504	72	118	438	298	16	150	208	187	216	174	<10	692	127	113	10
Percent of Cases	59.0%	41.0%	—	7.0%	39.5%	53.5%	7.6%	12.5%	46.5%	31.6%	1.7%	15.9%	22.1%	19.9%	22.9%	18.5%	—	73.5%	13.5%	12.0%	1.1%
1-year survival	87.7%	91.1%	—	77.1%	89.6%	90.3%	89.8%	74.1%	92.3%	90.0%	100.0%	94.5%	90.5%	88.3%	88.9%	83.7%	—	98.2%	92.7%	33.9%	60.0%
3-year survival	80.1%	85.5%	—	71.8%	83.4%	82.9%	83.5%	68.6%	84.8%	83.8%	91.7%	89.2%	84.0%	79.3%	82.6%	77.0%	—	96.0%	75.8%	13.1%	37.5%
5-year survival	76.4%	84.5%	—	71.8%	81.6%	79.4%	81.8%	64.4%	82.7%	81.0%	91.7%	86.6%	80.3%	74.7%	81.4%	76.2%	—	93.9%	72.1%	8.8%	37.5%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, KIDNEY CANCER, LOS ANGELES COUNTY, 1988-2014

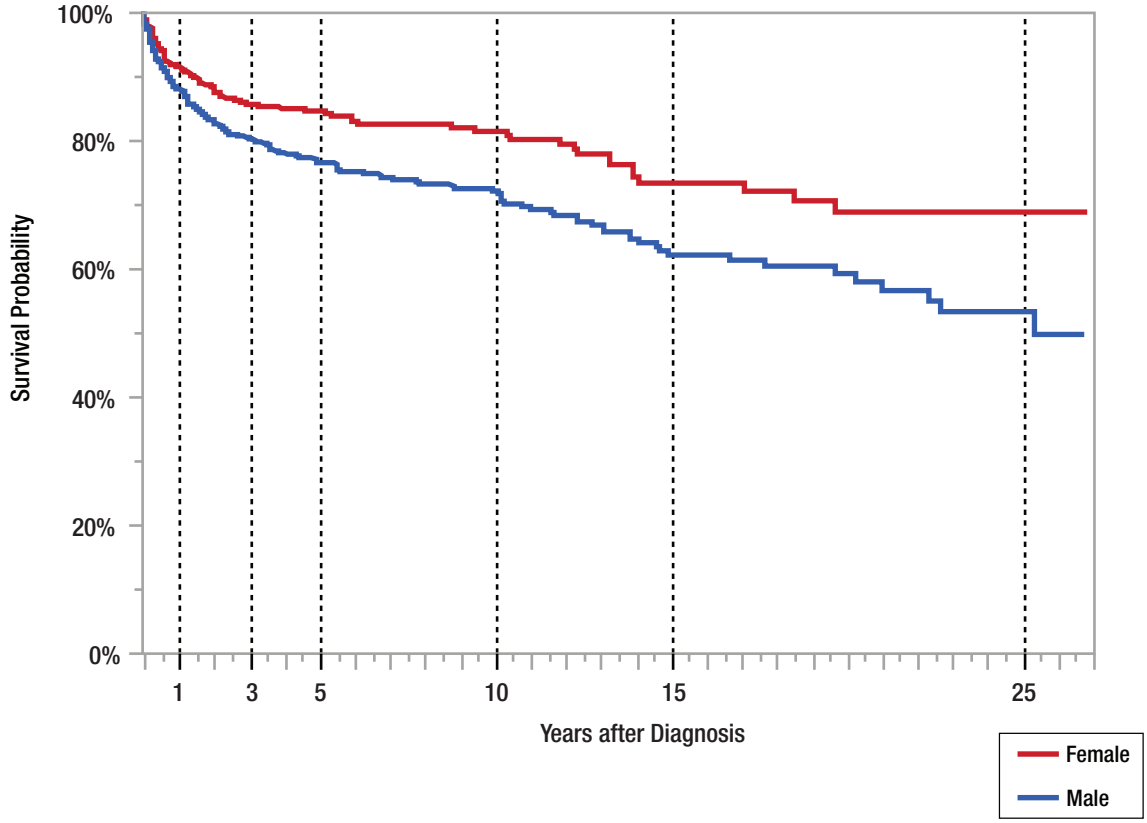


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, KIDNEY CANCER, LOS ANGELES COUNTY, 1988-2014

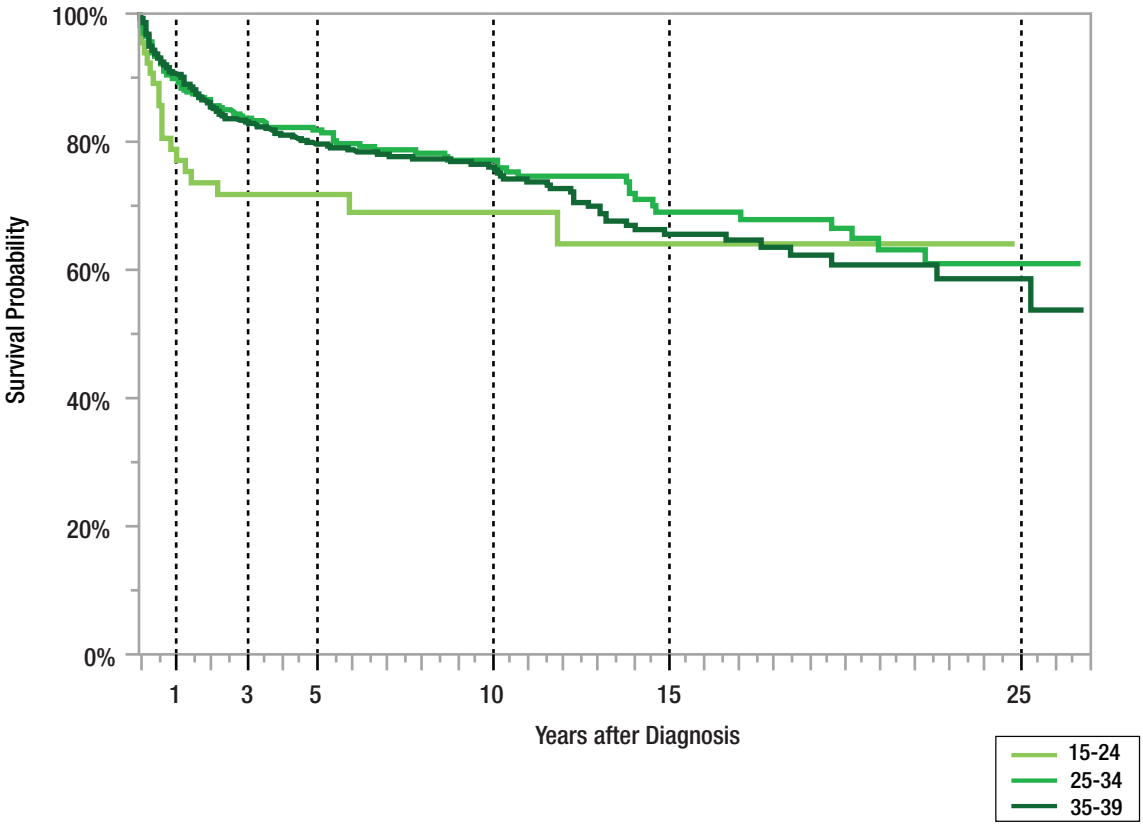


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, KIDNEY CANCER, LOS ANGELES COUNTY, 1988-2014

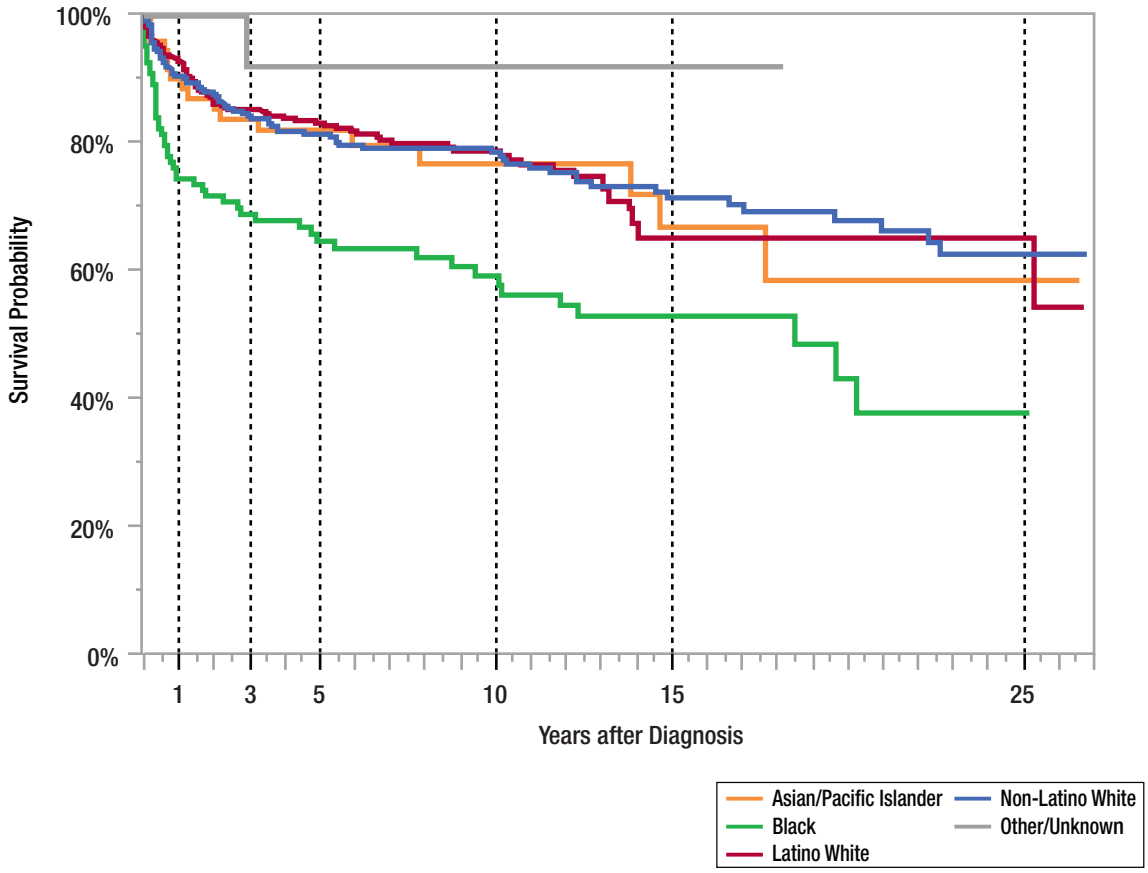


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, KIDNEY CANCER, LOS ANGELES COUNTY, 1988-2014

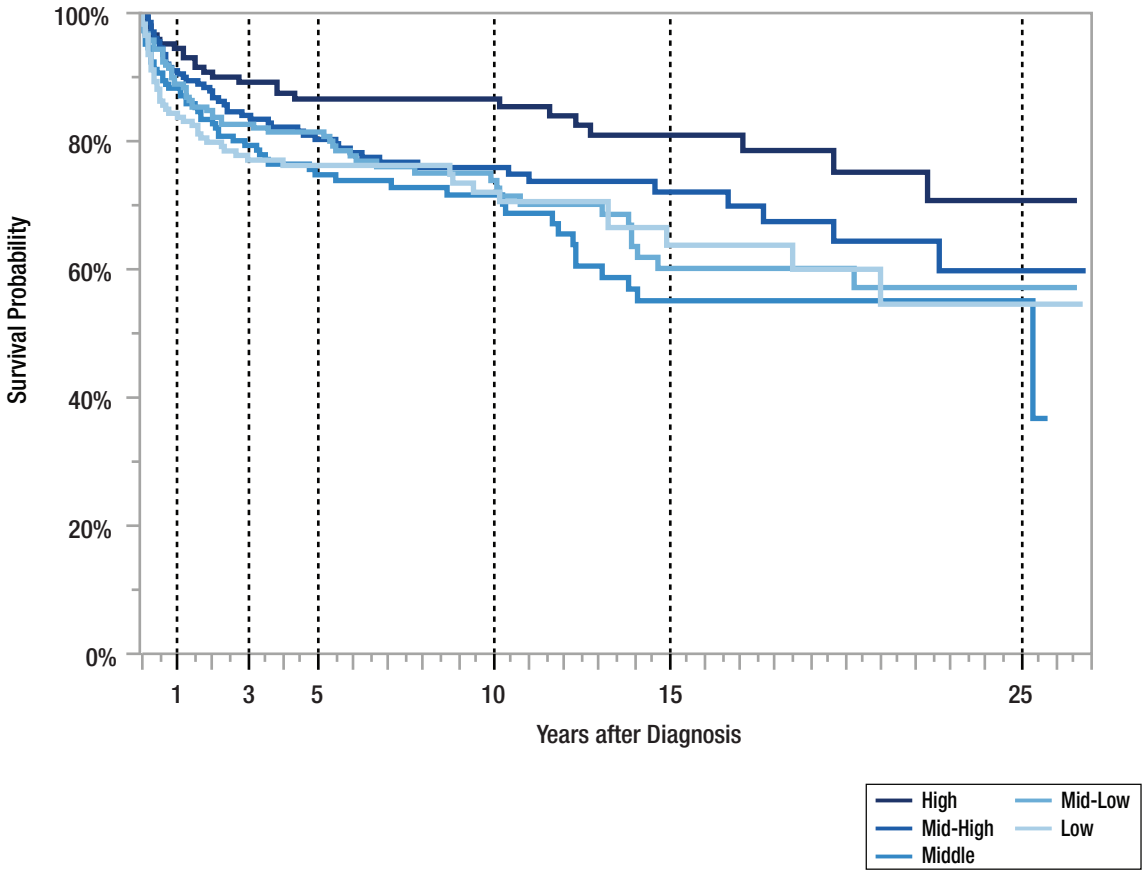
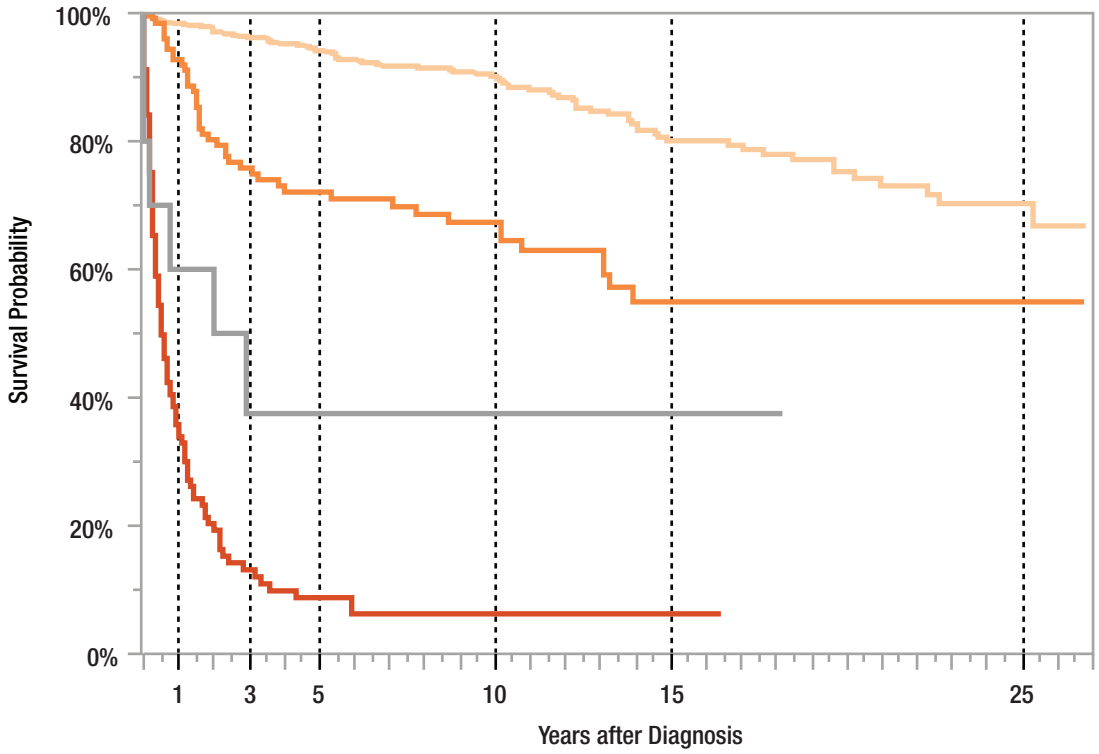


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, KIDNEY CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

LEUKEMIA

Diana Moke, MD
Ann Mohrbacher, MD
David R. Freyer, DO, MS

BACKGROUND

Leukemia is cancer of white blood cells. They come from the bone marrow, where red blood cells and platelets are also made. Healthy white blood cells circulate through the bloodstream to fight infection and assist in healing. Leukemia develops when white blood cells become unresponsive to normal signals from the body and multiply uncontrollably.

Leukemia is the tenth most common cancer among AYAs. Men develop leukemia more often than women. Past radiation or chemotherapy and certain genetic conditions, such as Down Syndrome, increase the risk for certain types of leukemia. However, the cause of the majority of leukemia cases is unknown. The most common types of leukemia in adolescents and young adults (AYAs) are acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML). ALL and AML are generally fast-growing and develop over a short period of time. A different type of leukemia in AYAs, called chronic myeloid leukemia (CML), tends to develop more gradually. Unlike cancers that form solid tumors, leukemia does not have stages.

Depending on the type of leukemia, treatment consists of chemotherapy, molecularly targeted medicines, and, occasionally, bone marrow transplant. In general, treatment is less successful among AYAs, as they have higher treatment failures for both ALL and AML than younger children. Compared to other age groups, several challenges face AYAs that affect their survival, such as differences in how their bodies handle chemotherapy, poor access to optimal cancer care, reduced likelihood of taking their medications, and less participation in clinical trials.

AYA SURVIVAL IN LOS ANGELES COUNTY

A total of 2,987 cases of leukemia were diagnosed in the AYA population in Los Angeles County during 1988-2014. There are slightly more cases of AML (1,195) than ALL (1,137), and both are more common than CML (655) (Table 1). In all forms of leukemia, men are diagnosed more often than women. AYAs with ALL tend to be younger than those with AML or CML (Table 1). AYAs with ALL also have higher percentage with lower socioeconomic status (SES) (Table 1). The majority of leukemia cases are seen in Latino whites, followed by non-Latino whites, Asian/Pacific Islanders, and blacks (Table 1).

ALL: In ALL, 5-year survival is approximately 40% for both men and women (Table 1, Figure 1A). Younger AYAs have better 5-year survival than older AYAs (48% for ages 15-24, 35% for ages 25-34, and 32% for ages 35-39) (Table 1, Figure 2A). While black ALL patients consistently have the worst survival (29%), Latino whites, who account for the majority of ALL cases, also have substantially lower survival than non-Latino whites (5-year survival 38% vs. 56%) (Table 1, Figure 3A). Poor survival also appears to associate with lower SES: 5-year survival is 55% for high SES and 36% for low SES (Table 1, Figure 4A).

AML: At 5 years, survival in AML is about the same for men and women (approximately 40%), and there are no apparent differences in survival by age group (Table 1, Figure 2B). Latino white and non- Latino white AYAs with AML have similar 5-year survival (43% and 44%, respectively), while 5-year survival of black AYAs remains the lowest (25%) (Table 1, Figure 3B). Unlike in ALL and CML, SES does not seem to affect AML survival as much, possibly because AML treatment is delivered in the hospital and less dependent on outpatient access and adherence than are ALL and CML treatments. (Table 1, Figure 4B).

CML: Compared to ALL and AML, 5-year survival for CML is higher (70%), regardless of sex or age (Table 1, Figures 1C, 2C). Unlike in ALL and AML, survival for CML steadily declines over time. There are sizable advantages in survival among non-black AYAs over black AYAs with CML (5-year survival: >70% vs. 57%) (Table 1, Figure 3C). As SES declines, the 5-year CML survival decreases (76% for high SES and 67% for low SES) (Table 1, Figure 4C).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

Leukemia	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Acute Lymphoid Leukemia																					
Number of Cases	752	385	—	644	336	157	62	55	796	203	21	104	153	193	305	373	<10	—	—	1,137	—
Percent of Cases	66.1%	33.9%	—	56.6%	29.6%	13.8%	5.5%	4.8%	70.0%	17.9%	1.8%	9.1%	13.5%	17.0%	26.8%	32.8%	—	—	—	100.0%	—
1-year survival	73.9%	73.3%	—	79.1%	68.9%	62.1%	82.4%	65.7%	72.8%	76.8%	70.8%	75.9%	75.8%	77.5%	74.5%	69.3%	—	—	—	73.7%	—
3-year survival	51.2%	46.6%	—	56.3%	41.7%	39.7%	59.8%	42.4%	46.4%	60.2%	50.6%	61.6%	51.9%	48.5%	53.7%	43.0%	—	—	—	49.6%	—
5-year survival	42.6%	41.1%	—	48.3%	35.4%	31.7%	51.7%	29.0%	38.2%	56.0%	50.6%	54.6%	45.1%	41.8%	44.0%	36.1%	—	—	—	42.1%	—
Acute Myeloid Leukemia																					
Number of Cases	641	554	—	381	528	286	161	89	599	329	17	152	217	252	274	291	<10	—	—	1,195	—
Percent of Cases	53.6%	46.4%	—	31.9%	44.2%	23.9%	13.5%	7.4%	50.1%	27.5%	1.4%	12.7%	18.2%	21.1%	22.9%	24.4%	—	—	—	100.0%	—
1-year survival	64.5%	62.8%	—	65.9%	63.6%	61.0%	67.1%	54.4%	64.4%	62.9%	73.3%	69.4%	67.7%	60.6%	63.0%	61.9%	—	—	—	63.7%	—
3-year survival	44.2%	48.5%	—	50.3%	44.7%	43.4%	48.3%	28.1%	47.5%	47.8%	41.3%	54.0%	49.9%	41.8%	45.0%	44.8%	—	—	—	46.2%	—
5-year survival	40.0%	43.4%	—	45.3%	39.9%	39.6%	39.6%	25.2%	43.3%	44.2%	33.0%	49.1%	43.7%	39.1%	39.1%	41.3%	—	—	—	41.5%	—
Chronic Myeloid Leukemia																					
Number of Cases	408	247	—	135	314	206	75	66	298	190	26	115	114	121	153	144	<10	—	—	655	—
Percent of Cases	62.3%	37.7%	—	20.6%	47.9%	31.5%	11.5%	10.1%	45.5%	29.0%	4.0%	17.6%	17.4%	18.5%	23.4%	22.0%	—	—	—	100.0%	—
1-year survival	91.9%	91.5%	—	93.2%	90.6%	92.5%	93.0%	80.2%	92.7%	93.3%	96.2%	94.5%	90.0%	94.8%	92.7%	88.6%	—	—	—	91.8%	—
3-year survival	76.0%	78.1%	—	76.7%	73.0%	82.3%	79.8%	60.3%	77.2%	79.8%	84.5%	84.4%	82.4%	72.4%	75.9%	71.7%	—	—	—	76.8%	—
5-year survival	70.3%	71.1%	—	68.5%	67.9%	75.9%	72.0%	56.7%	72.5%	71.5%	76.0%	76.2%	77.0%	67.3%	67.2%	68.2%	—	—	—	70.6%	—

* Leukemia occurs in the blood cells throughout the body, thus it is not staged as other solid tumors.

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

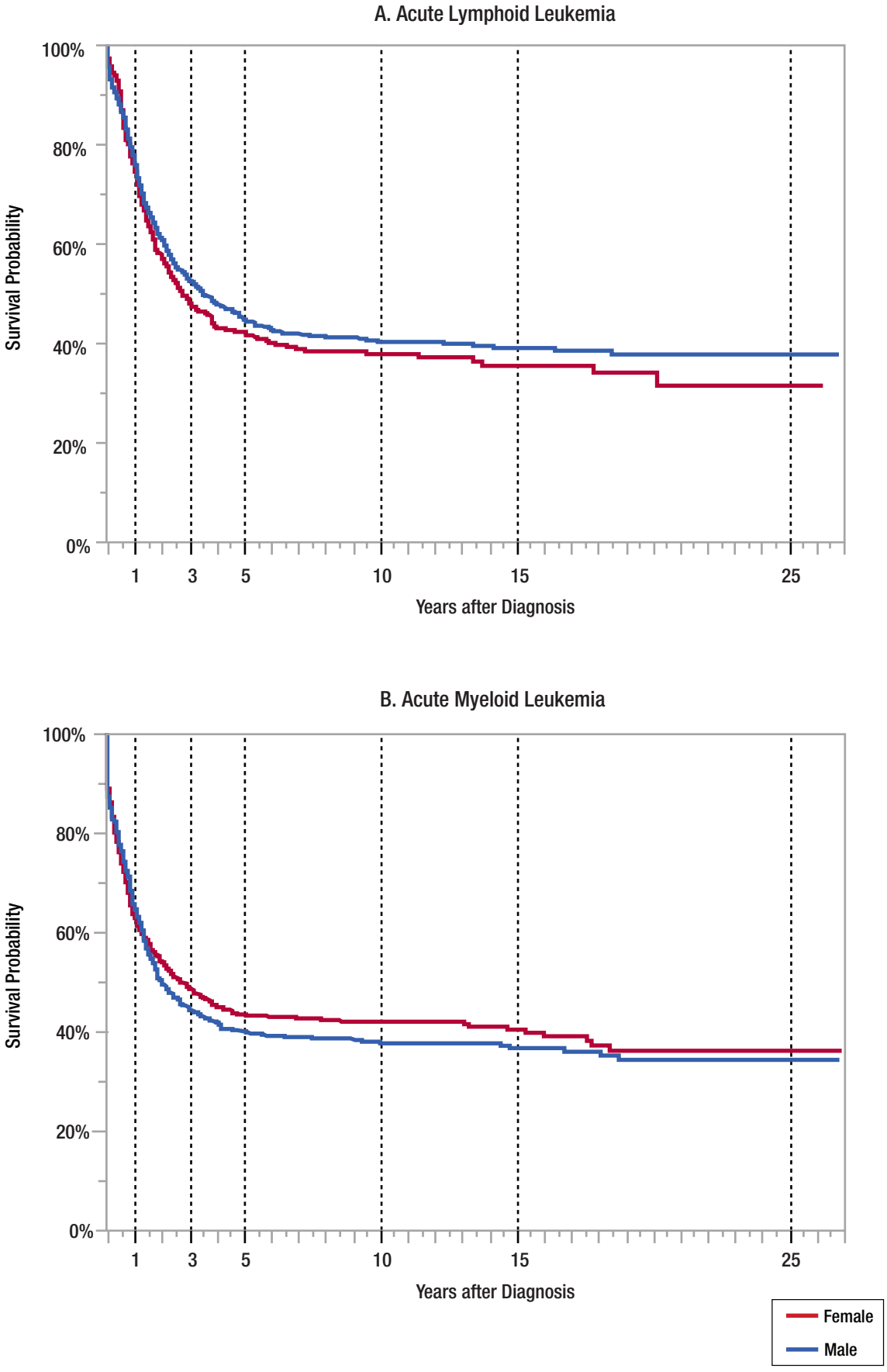


FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

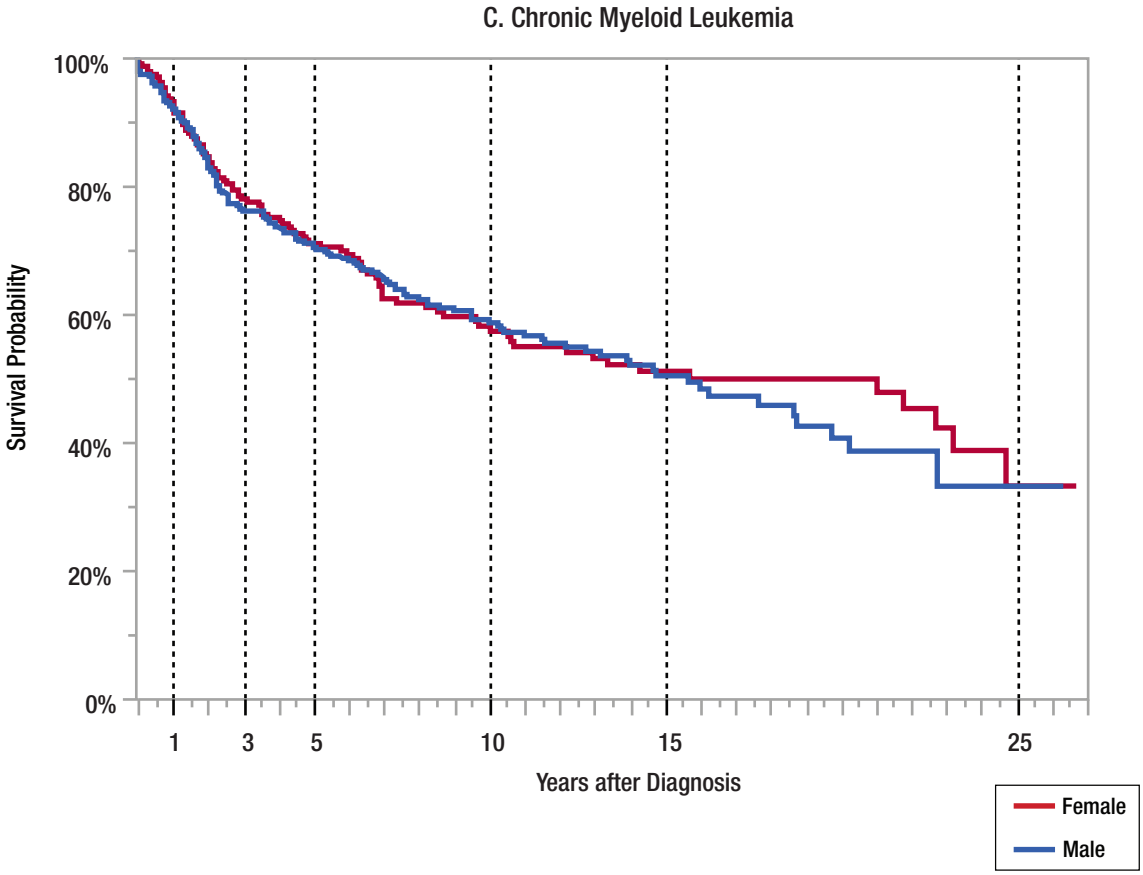


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

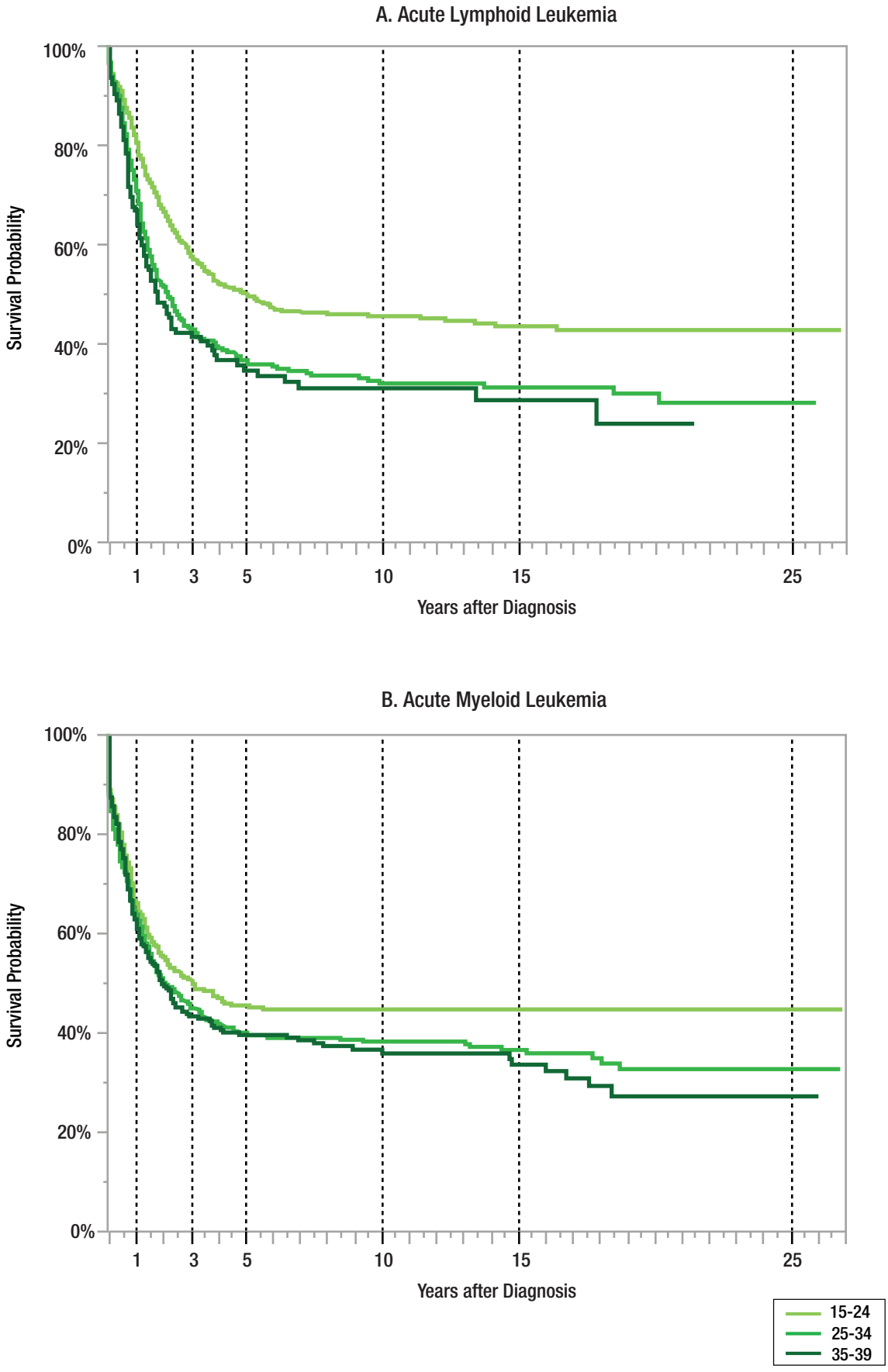


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

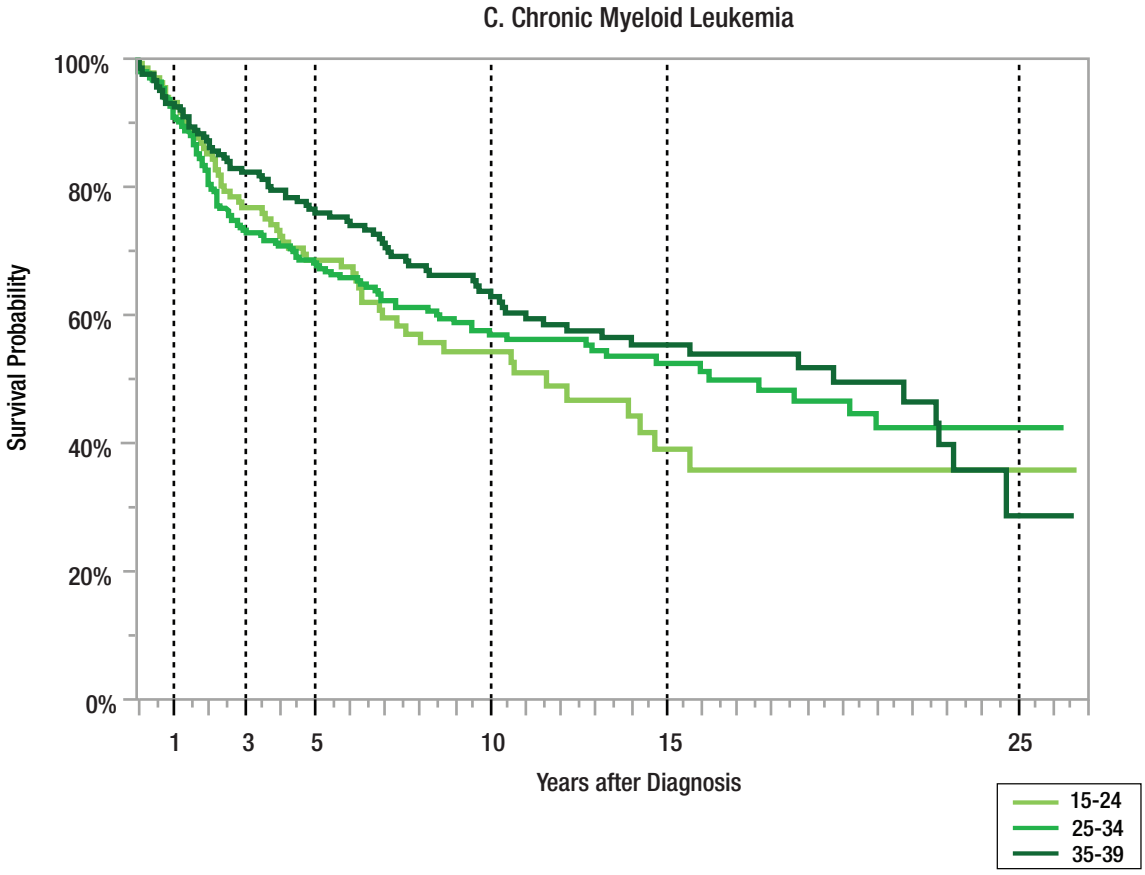


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

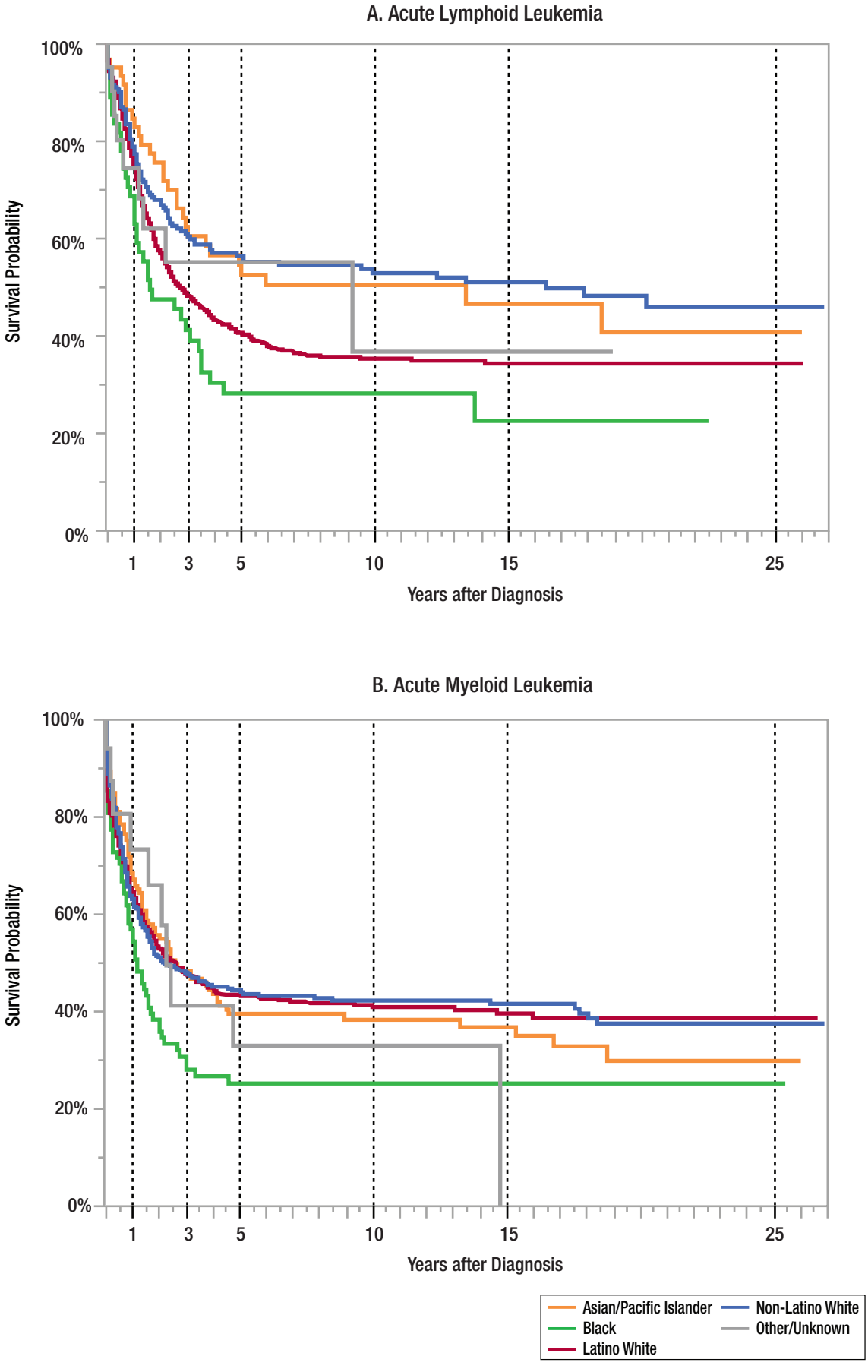


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

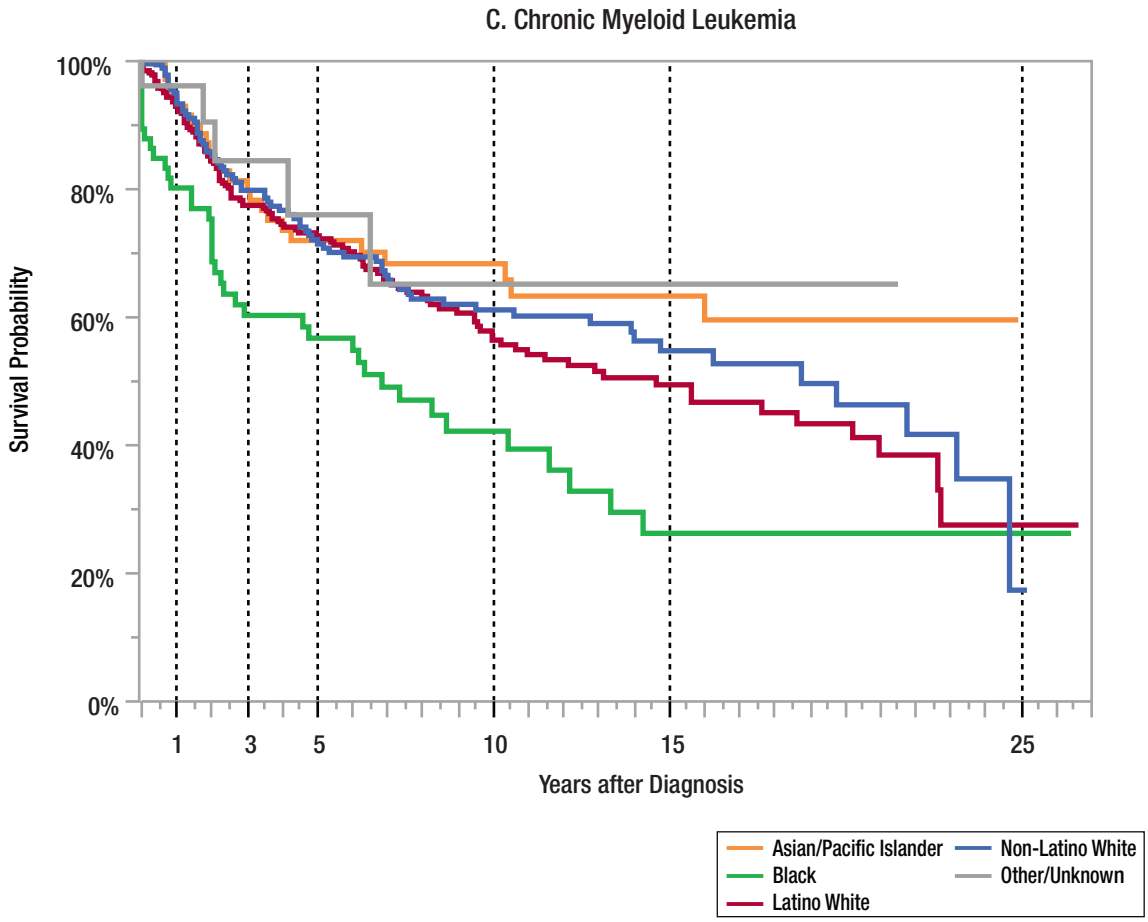


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

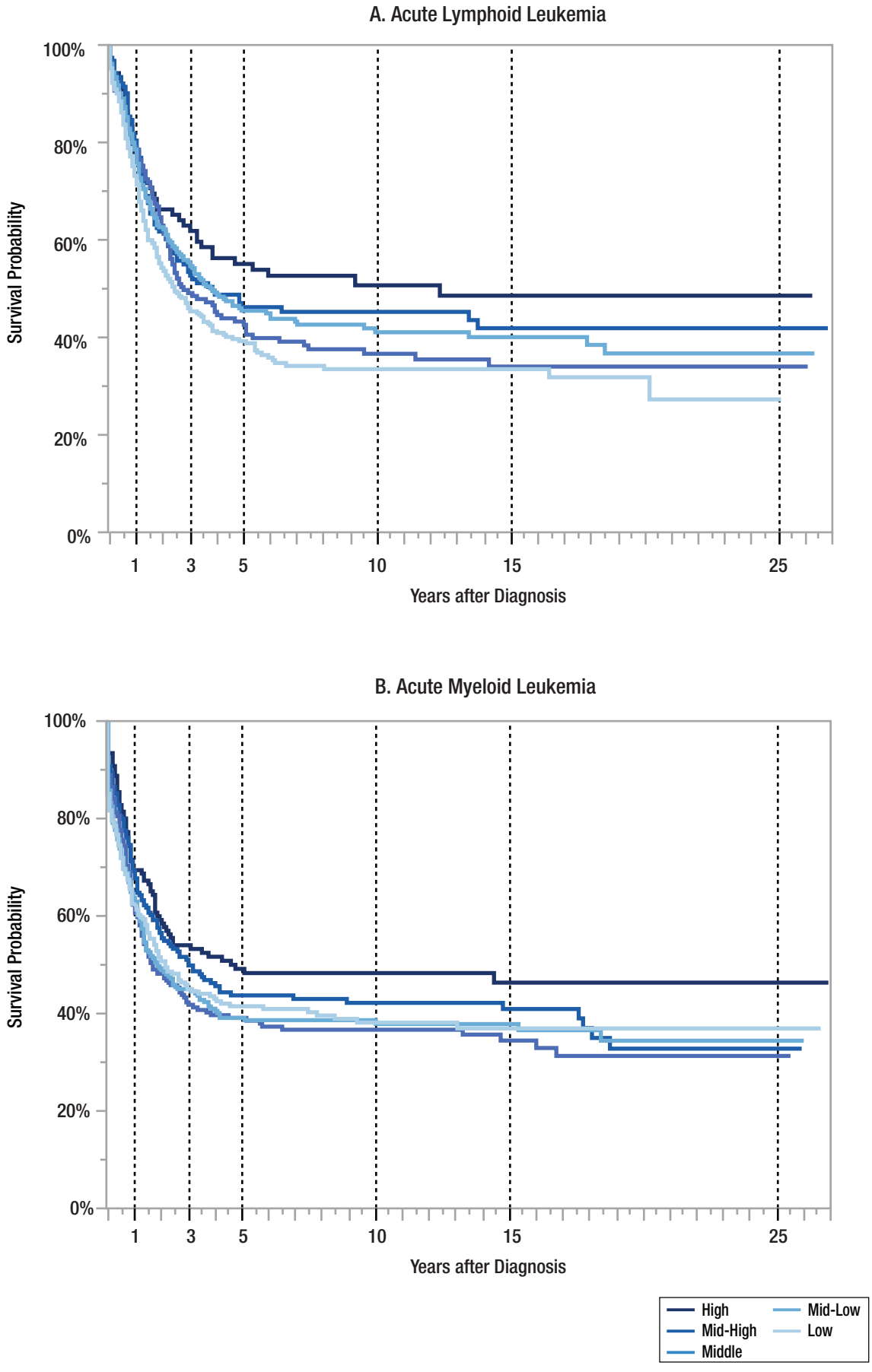


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014

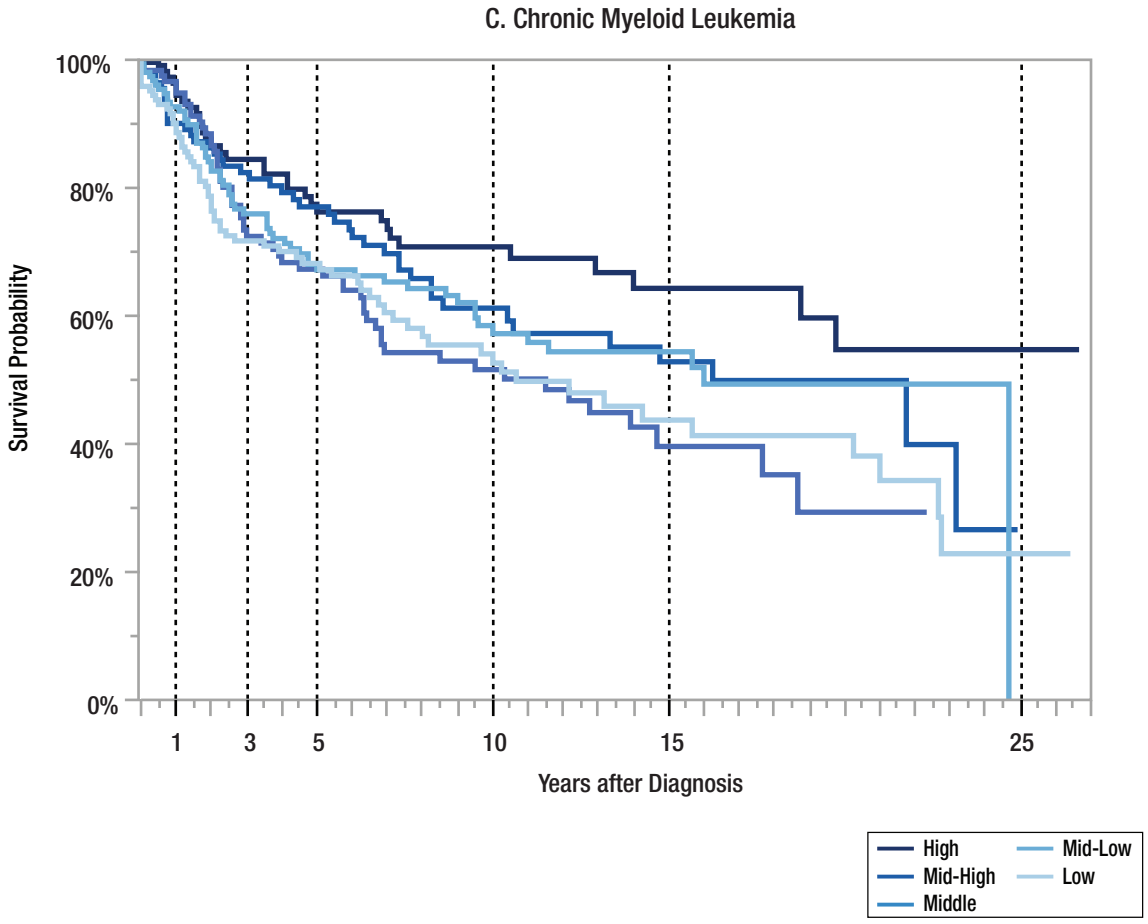
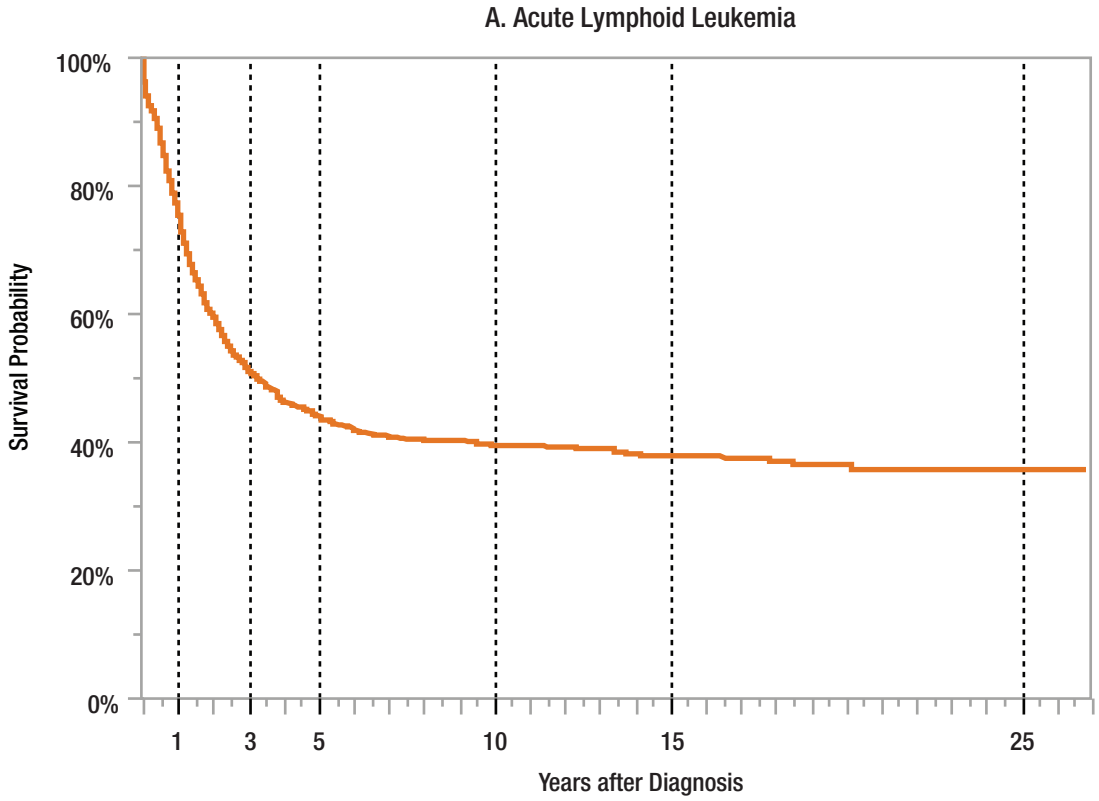
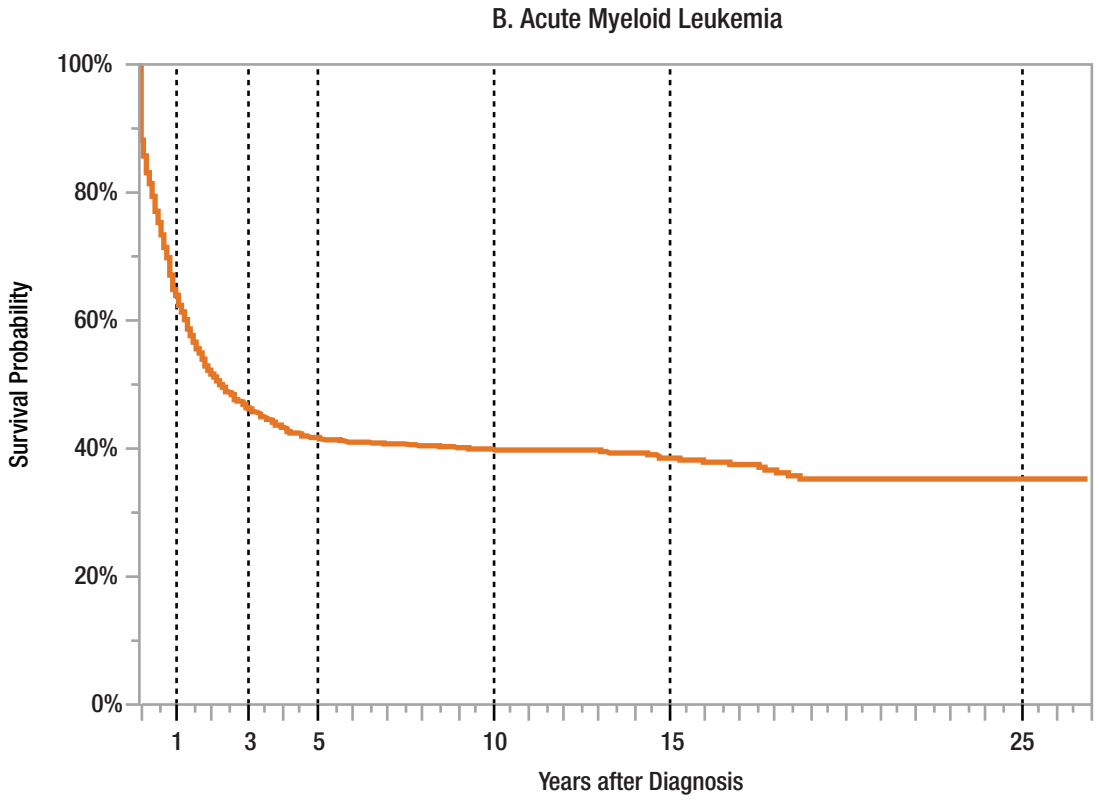


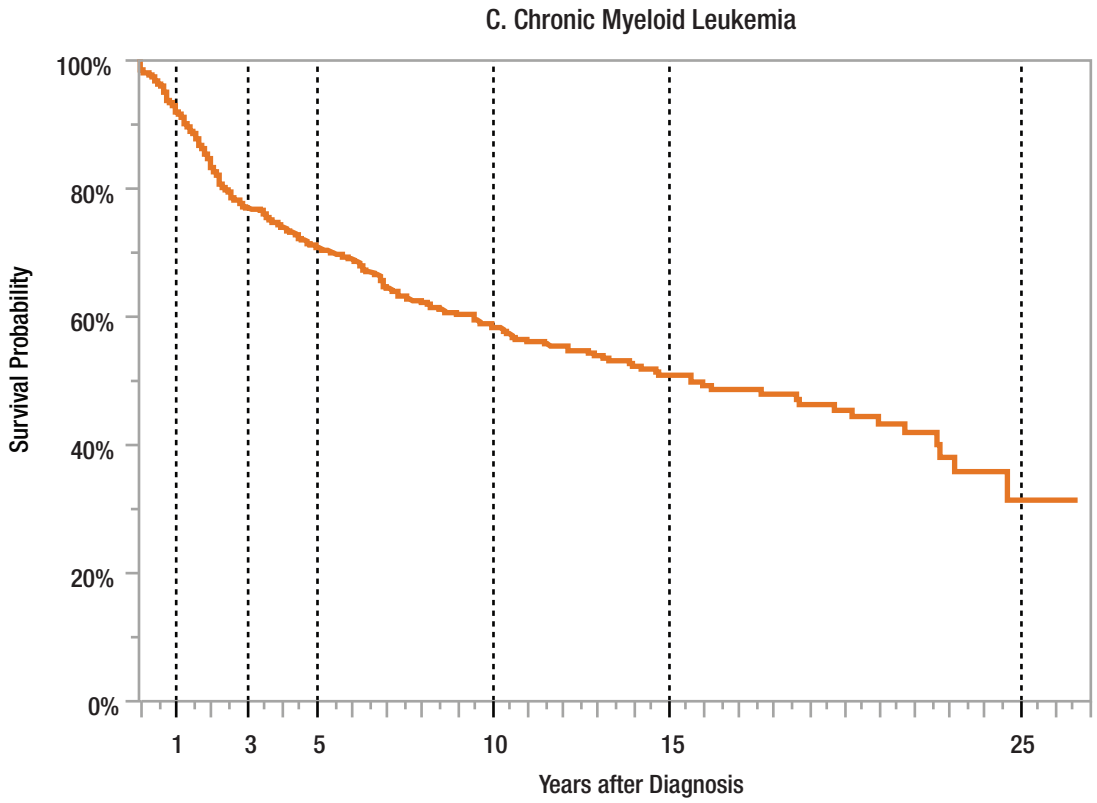
FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014





* Leukemia occurs in the blood cells throughout the body, thus it is not staged as other solid tumors.

FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, LEUKEMIA, LOS ANGELES COUNTY, 1988-2014



* Leukemia occurs in the blood cells throughout the body, thus it is not staged as other solid tumors.

LIP, ORAL CAVITY AND PHARYNX

Lihua Liu, PhD
Jorge J. Nieva, MD

BACKGROUND

Cancers of the lip, oral cavity and pharynx represent the malignant tumors occurring in the mouth and throat. Nearly 50,000 Americans are diagnosed with these cancers annually. More than 9,000 deaths are caused by these cancers every year. The majority (64%) of these cancers happen inside the oral cavity, including the tongue, gum, floor of mouth, inside of cheeks, and salivary glands. About 25% of these cancers occur in the throat (pharynx), and the smallest share (11%) occur on the lip. Among adolescent and young adult (AYA) Americans aged 15-39, this group of cancers accounts for about 2% of all new cancer diagnoses.

Tobacco use in any form (smoked and smokeless) and excessive alcohol consumption are major risk factors for these cancers. The combined effects of both smoking and heavy drinking can increase the risk of developing these cancers by 30 times. Many other risk factors have also been linked to these cancers. For example, extended exposure to sunlight may increase the risk of lip cancer, and infection caused by the human papilloma virus (HPV) through sexual contact is associated with cancers in the base of tongue and throat. HPV infection is believed to be responsible for the recent rise in this group of cancers among young white men and women. Long-term irritation to the tissues in the mouth can lead to cancer development. This is why piercing inside the mouth and tongue splitting are highly discouraged by the American Dental Association and the American Academy of Pediatric Dentistry.

Standard treatment for these cancers includes radiation therapy and surgery, separately or in combination; chemotherapy is added for late stage* disease. Survival of these cancers varies greatly depending on the tumor location and stage* of disease at diagnosis. Overall as a group, these cancers have an average 5- year relative survival rate of 63%. If diagnosed at an early stage*, the 5-year survival is 83%. Among AYAs in the U.S., the average 5-year relative survival rate of these cancers is 81%. Visual inspection by dentists and physicians is very effective in detecting precancerous abnormalities and cancer at an early stage* when treatment can be less extensive and more successful.

AYA SURVIVAL IN LOS ANGELES COUNTY

During 1988-2014, a total of 966 cases of cancers in the lip, oral cavity and pharynx were diagnosed among the County's AYA residents (Table 1). Of these patients, there are more men (56%) than women (44%) and more whites (41% non-Latino white and 30% Latino white) than non-whites (13% Asian/Pacific Islander and 13% black). The numbers increase substantially with age and are rather evenly distributed by socioeconomic status (SES). A little over half (55%) are diagnosed at early stage*.

There are clear survival differences in this group of cancers by sex, age, race/ethnicity, SES, and stage* (Table 1, Figures 1-5). Women have better survival than men (e.g., 5-year survival rates 82% vs. 73%) (Table 1, Figure 1). Younger age is associated with better survival (e.g., 5-year survival rates: 92% for ages 15-24 vs. 72% for ages 35-39) (Table 1, Figure 2). Blacks have the poorest survival as compared to all other racial/ethnic groups (e.g., 5-year survival rates 61% vs. 71% or higher) (Table 1, Figure 3). In general, people of higher SES appear to have a slightly better survival rate than those of lower SES (e.g., 5-year survival rates: 82% for high SES vs. 72% for low SES) (Table 1, Figure 4). The 5-year survival rate of early stage* disease is substantially higher than that of the late stage* (89% vs. 33%) (Table 1, Figure 5).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, LIP, ORAL CAVITY AND PHARYNX CANCER, LOS ANGELES COUNTY, 1988-2014

Lip, Oral Cavity and Pharynx Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	539	427	—	117	399	450	124	125	286	396	35	189	205	199	199	166	<10	533	309	75	49
Percent of Cases	55.8%	44.2%	—	12.1%	41.3%	46.6%	12.8%	12.9%	29.6%	41.0%	3.6%	19.6%	21.2%	20.6%	20.6%	7.2%	—	-55.2%	32.0%	7.8%	5.1%
1-year survival	89.1%	93.8%	—	97.2%	93.0%	88.0%	90.0%	80.8%	94.1%	92.5%	96.7%	94.0%	89.5%	93.8%	91.6%	86.9%	—	97.3%	87.4%	69.4%	82.1%
3-year survival	77.1%	84.7%	—	92.4%	81.3%	76.7%	78.8%	64.2%	83.2%	83.8%	85.4%	87.2%	79.0%	83.5%	77.3%	75.1%	—	91.6%	71.2%	45.0%	70.6%
5-year survival	72.7%	81.8%	—	92.4%	78.0%	71.6%	71.1%	60.6%	78.4%	81.5%	85.4%	81.6%	77.2%	80.6%	71.8%	71.9%	—	89.0%	67.5%	32.5%	65.6%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, LIP, ORAL CAVITY AND PHARYNX CANCER, LOS ANGELES COUNTY, 1988-2014

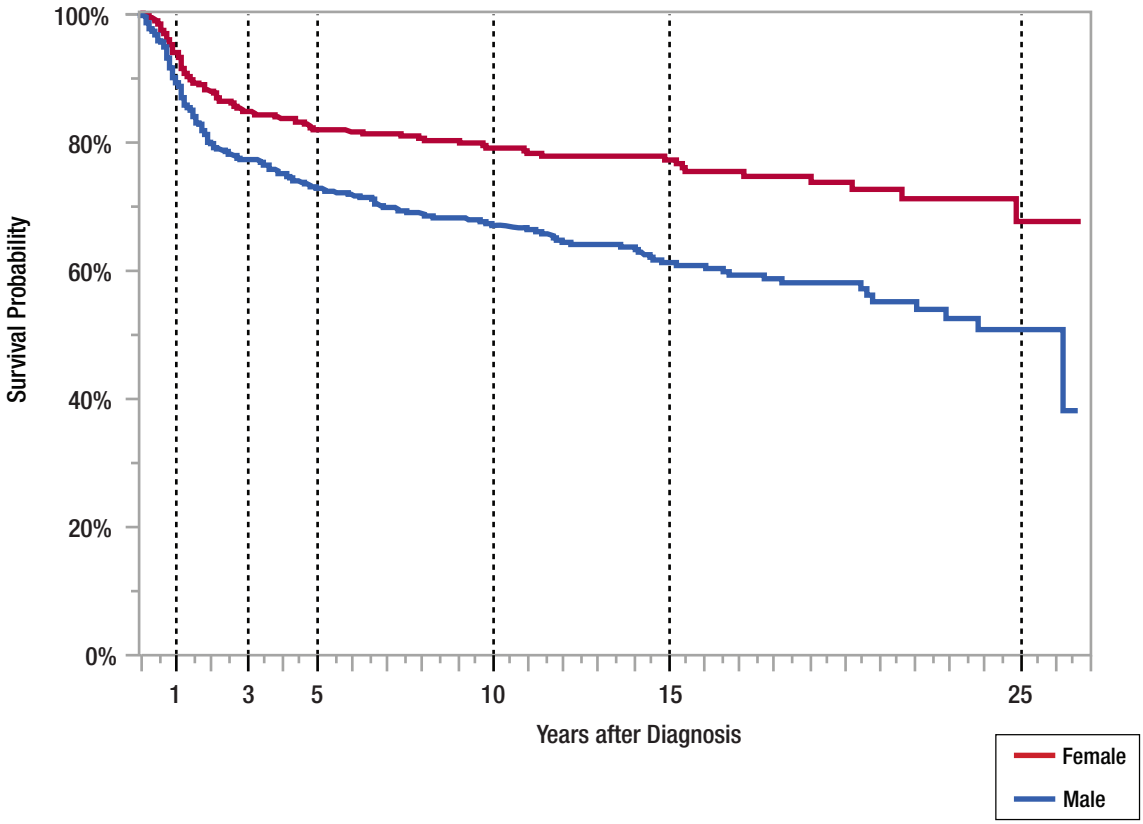


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, LIP, ORAL CAVITY AND PHARYNX CANCER, LOS ANGELES COUNTY, 1988-2014

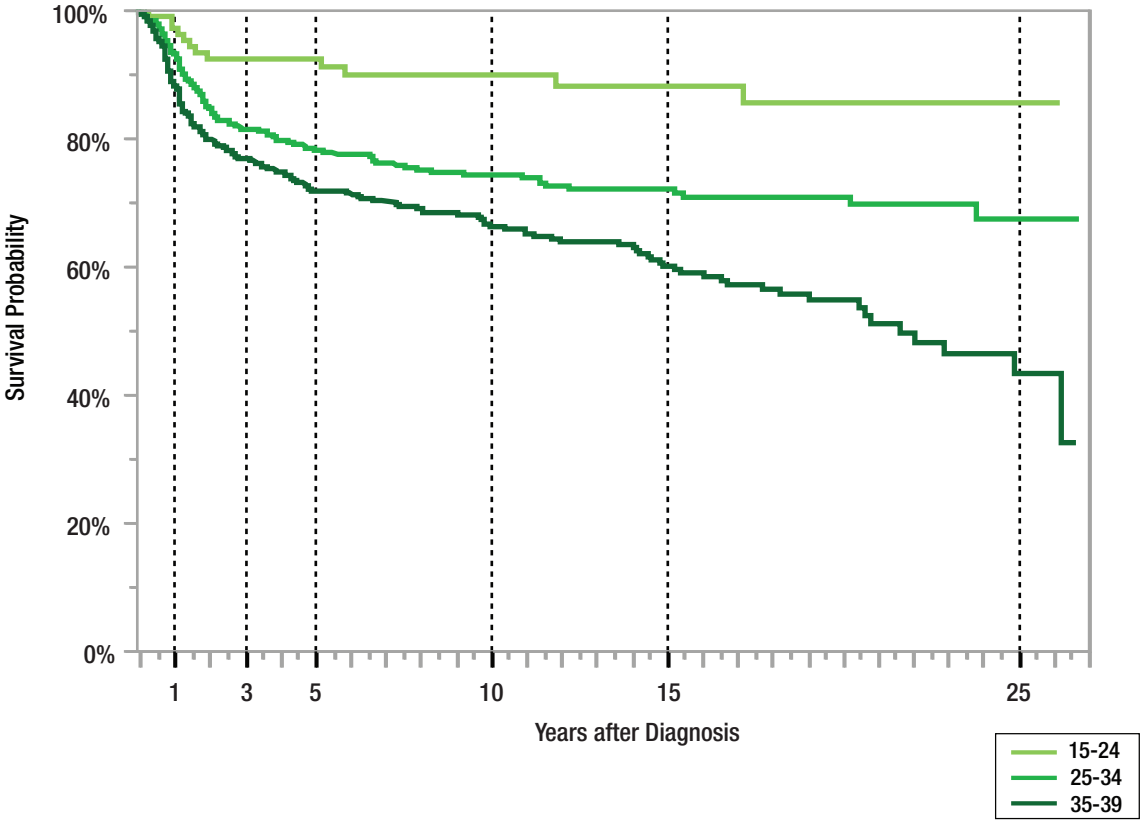


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, LIP, ORAL CAVITY AND PHARYNX CANCER, LOS ANGELES COUNTY, 1988-2014

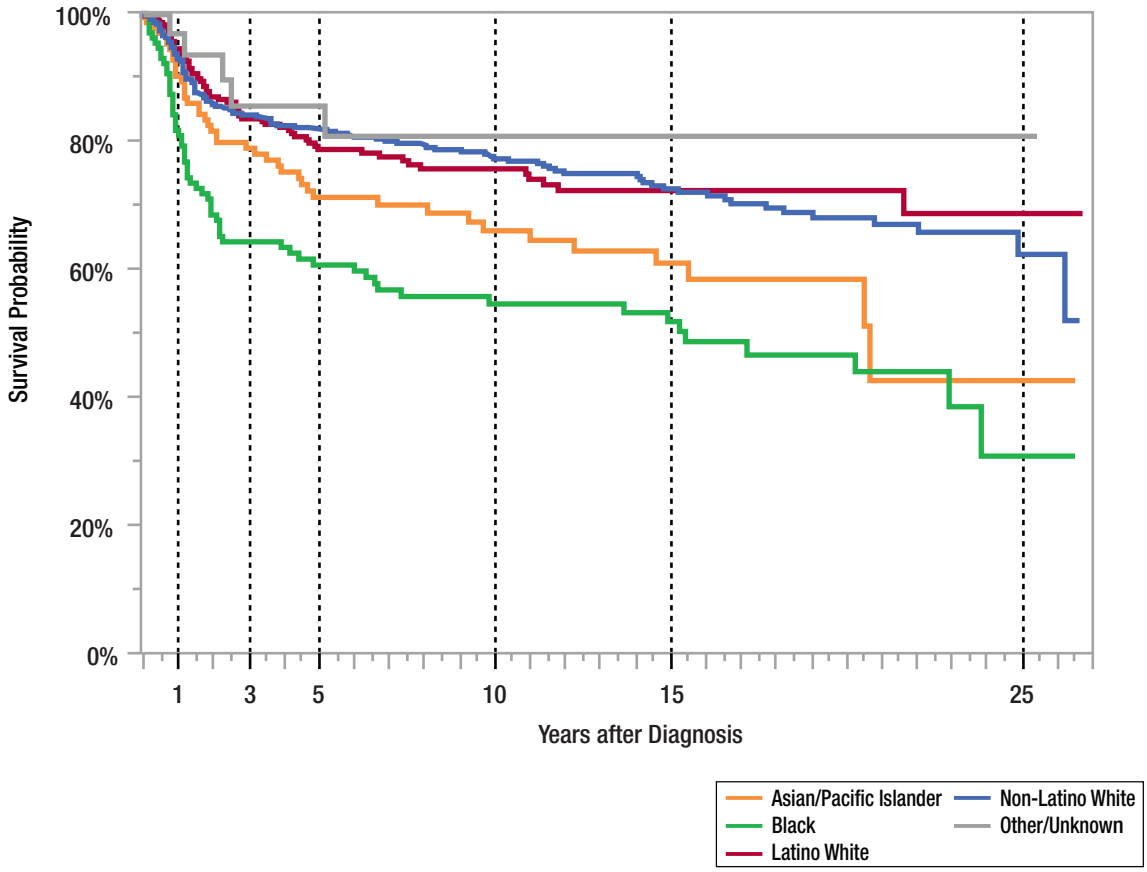


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, LIP, ORAL CAVITY AND PHARYNX CANCER, LOS ANGELES COUNTY, 1988-2014

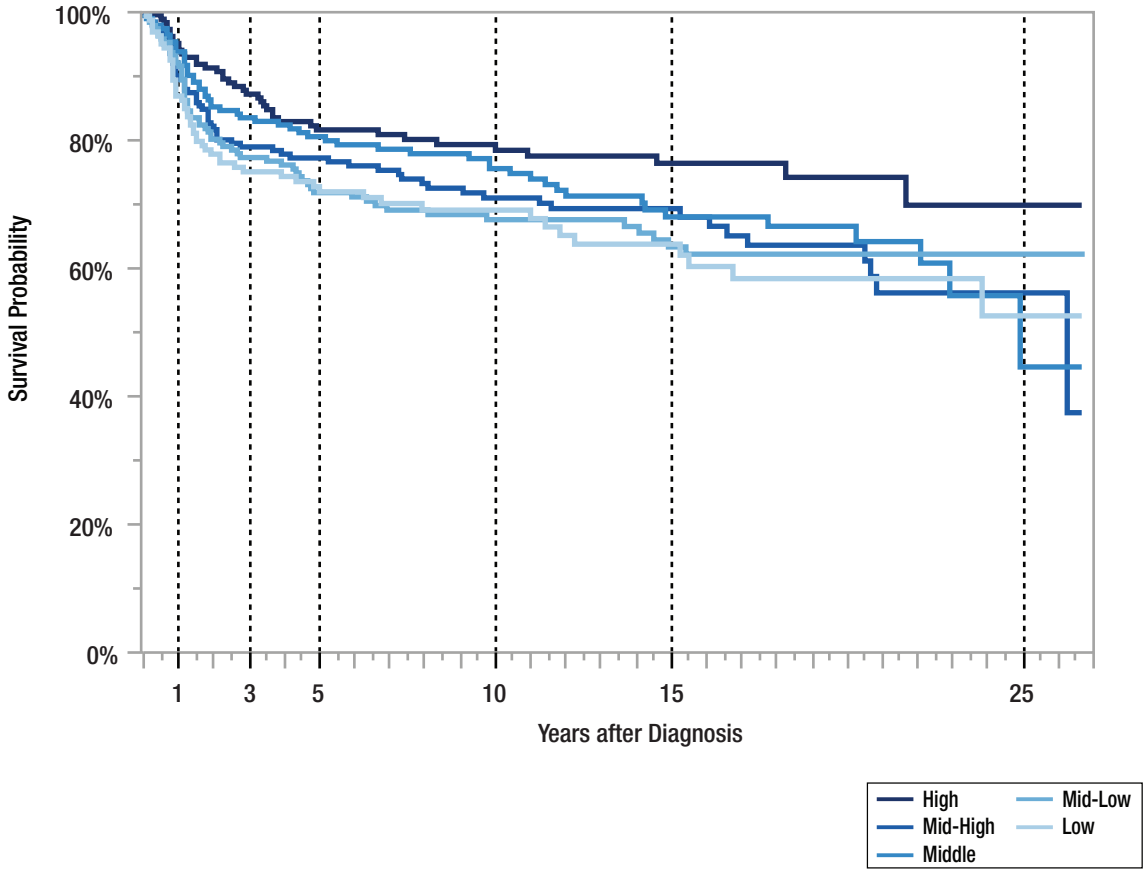
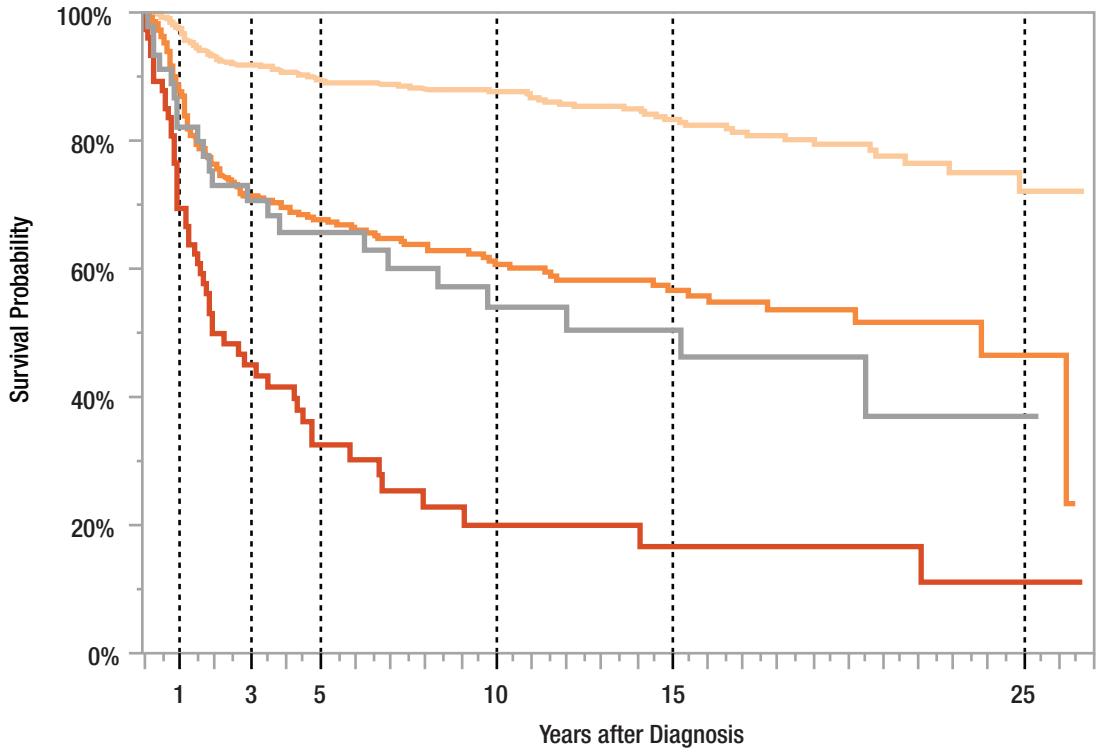


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, LIP, ORAL CAVITY AND PHARYNX CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

LUNG

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BACKGROUND

Lung cancer is relatively rare in the adolescent and young adult (AYA) population, as less than <2% of new cases in the U.S. are diagnosed in AYAs. Although lung cancer in young people is uncommon, lung cancer is the leading cause of cancer death in men and women in the U.S. and is estimated to cause more than 21,000 young adult deaths per year nationwide.

The leading cause of lung cancer is smoking; however, there are differences in risk factors for lung cancer in the AYA population as compared to the older population. AYAs with lung cancer are less likely to be smokers and more likely to have been born with a genetic susceptibility for lung cancer. Young adults with lung cancer are more likely to have a certain genetic mutation in the cancer cells that helps the cancer cell grow and spread. It is found in about 50% of young adults with lung cancer. New medicines are now available to target these mutations.

There are different subtypes of lung cancer that affect treatment options and survival. One specific subtype of lung cancer, called adenocarcinoma, accounts for the majority (80%) of lung cancers in young adults.

Treatment options for lung cancer depend on the stage* at diagnosis. Surgery is the primary treatment for early stage* disease. Unfortunately, AYA groups tend to have more late stage* lung cancer at the time of diagnosis than older patients. In general, despite being diagnosed at a later stage*, younger patients appear to have somewhat better survival than older patients.

AYA SURVIVAL IN LOS ANGELES COUNTY

Lung cancer survival rates among AYAs in Los Angeles County during 1988-2014 vary by a number of factors. Lung cancer diagnosed at an early stage* has the best prognosis, with the 5-year survival rate of 86% for early stage* disease, 44% for regional stage*, and 5% for the latest stage* disease (Table 1, Figure 5). Unfortunately, only 18% of AYA lung cancer cases are diagnosed at early stage* (Table 1). The 5-year survival rates are higher for women than men (32% vs. 25%) (Table 1, Figure 1); lower for Asian/Pacific Islanders and blacks (17% and 18%, respectively) than for Latino whites or non-Latino whites (32% and 34%, respectively) (Table 1, Figure 3); lower for patients in the lower socioeconomic status (SES) group as compared to the highest (20% for the lowest SES vs. 40% for the highest SES) (Table 1, Figure 4); and highest for the youngest patients (63% for 15-24 year olds, 36% for 25-34 year olds, and 21% for 35-39 year olds) (Table 1, Figure 2). By lung cancer histologic subtype, adenocarcinoma is the most commonly diagnosed type of lung cancer among AYAs, accounting for 47% of all lung cancer cases (Table 1). Carcinoid lung cancer, more common in the younger age groups, has dramatically better 5-year survival rate (95%) than all other subtypes (Table 1, Figure 6). Following carcinoid tumors, squamous cell cancers have the next highest 5-year survival (26%), followed by other carcinomas (21%), adenocarcinomas (15%), large cell lung cancer (12%), and small cell lung cancer (9%) (Table 1, Figure 6).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, LUNG CANCER, LOS ANGELES COUNTY, 1988-2014

Lung Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*				Histology					
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown	Adenocarcinoma	Carcinoid	Large Cell	Other Carcinoma	Small Cell	Squamous and Transitional
Number of Cases	493	458	—	66	312	573	137	144	265	388	17	148	188	216	195	197	<10	175	160	548	68	443	140	42	186	53	87
Percent of Cases	51.8%	48.2%	—	6.9%	32.8%	60.3%	14.4%	15.1%	27.9%	40.8%	1.8%	15.6%	19.8%	22.7%	20.5%	20.7%	—	18.4%	16.8%	57.6%	7.2%	46.6%	14.7%	4.4%	19.6%	5.6%	9.1%
1-year survival	44.5%	59.9%	—	76.4%	56.5%	46.8%	53.9%	35.1%	56.6%	54.8%	45.4%	64.7%	57.8%	52.0%	48.9%	39.8%	—	93.0%	70.9%	32.3%	60.3%	47.3%	97.8%	28.6%	41.0%	30.8%	52.1%
3-year survival	28.7%	38.5%	—	62.6%	39.0%	27.2%	21.9%	18.9%	38.1%	39.4%	45.4%	43.5%	38.2%	36.1%	28.2%	23.2%	—	87.5%	53.3%	8.9%	39.2%	21.9%	95.4%	19.0%	25.2%	15.0%	28.7%
5-year survival	25.1%	32.4%	—	62.6%	35.5%	21.3%	16.5%	18.2%	32.4%	33.8%	34.1%	39.6%	30.7%	30.6%	23.9%	20.4%	—	85.5%	44.4%	4.7%	29.8%	15.3%	95.4%	11.9%	20.7%	8.6%	26.1%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, LUNG CANCER, LOS ANGELES COUNTY, 1988-2014

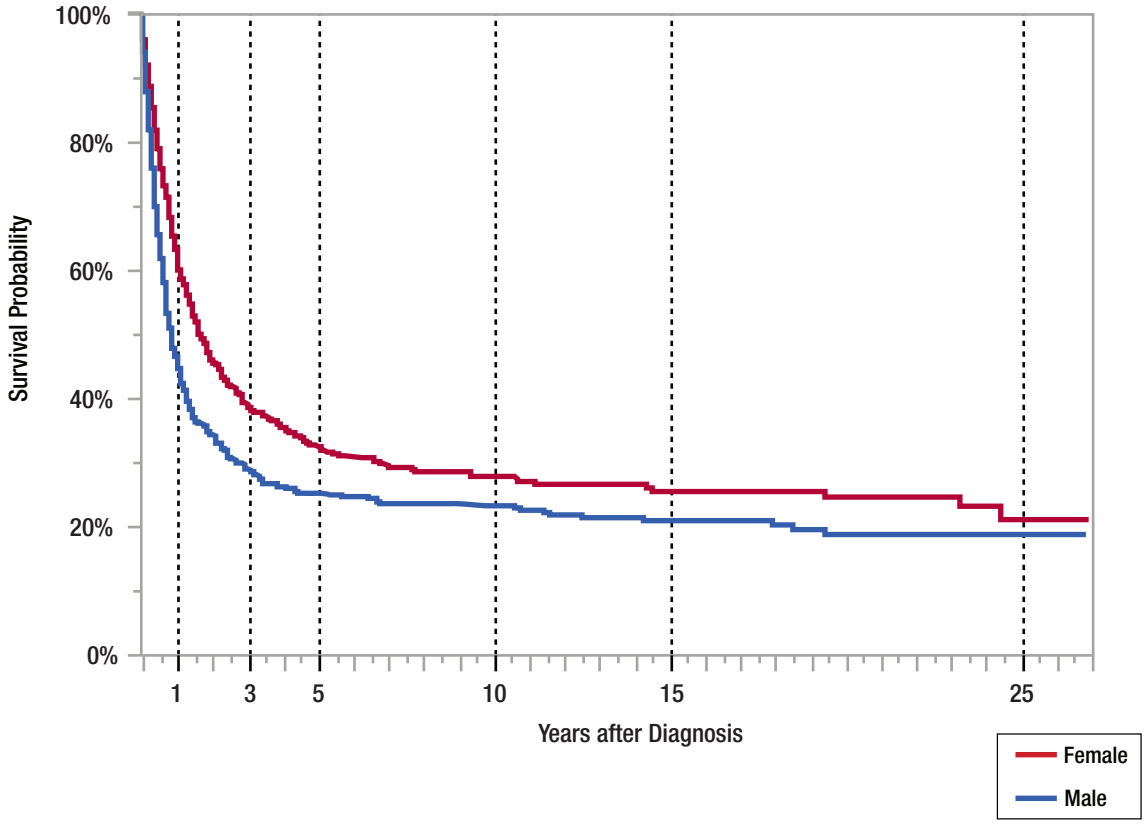


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, LUNG CANCER, LOS ANGELES COUNTY, 1988-2014

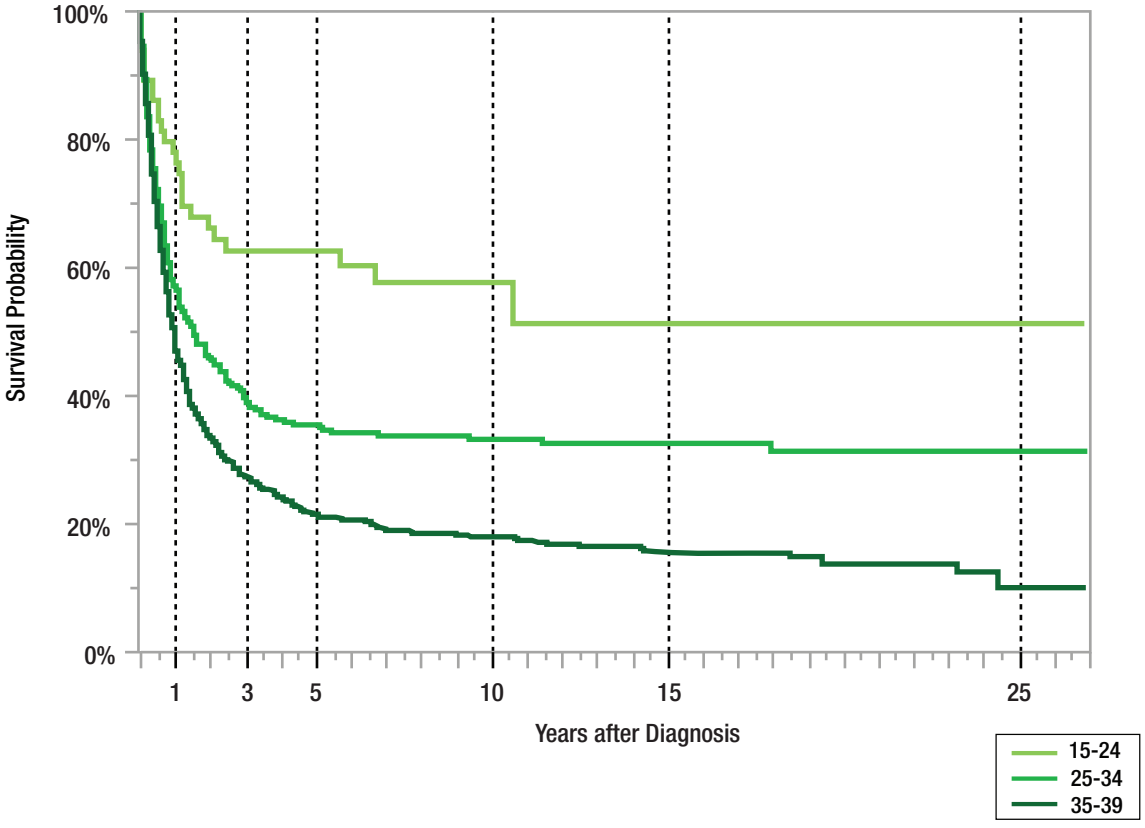


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, LUNG CANCER, LOS ANGELES COUNTY, 1988-2014

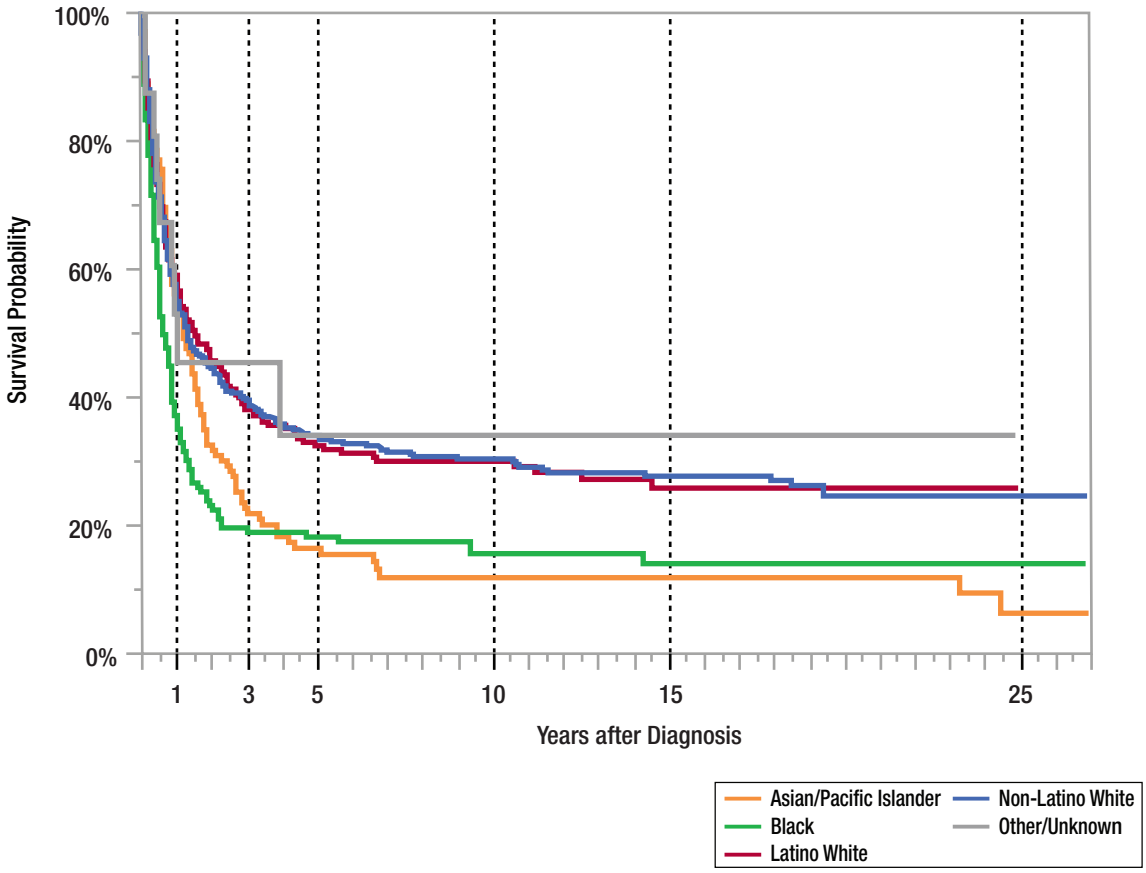


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, LUNG CANCER, LOS ANGELES COUNTY, 1988-2014

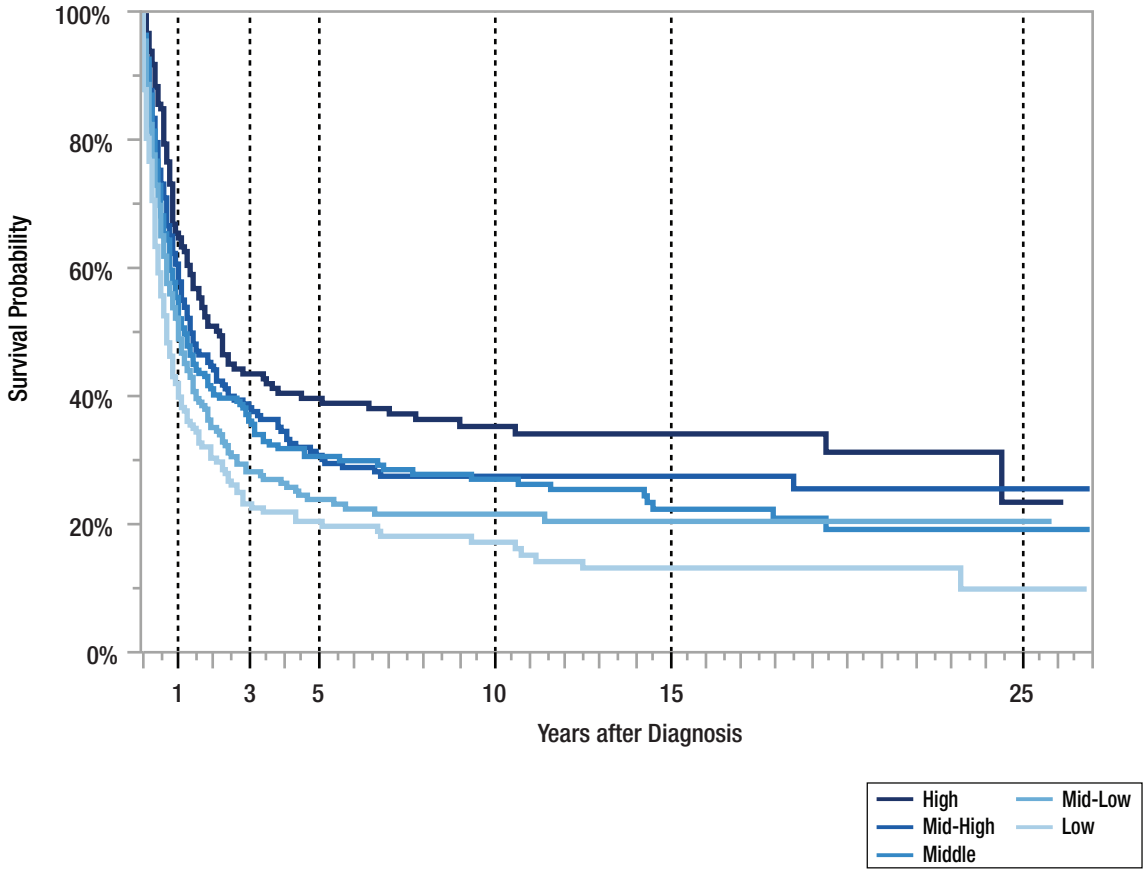
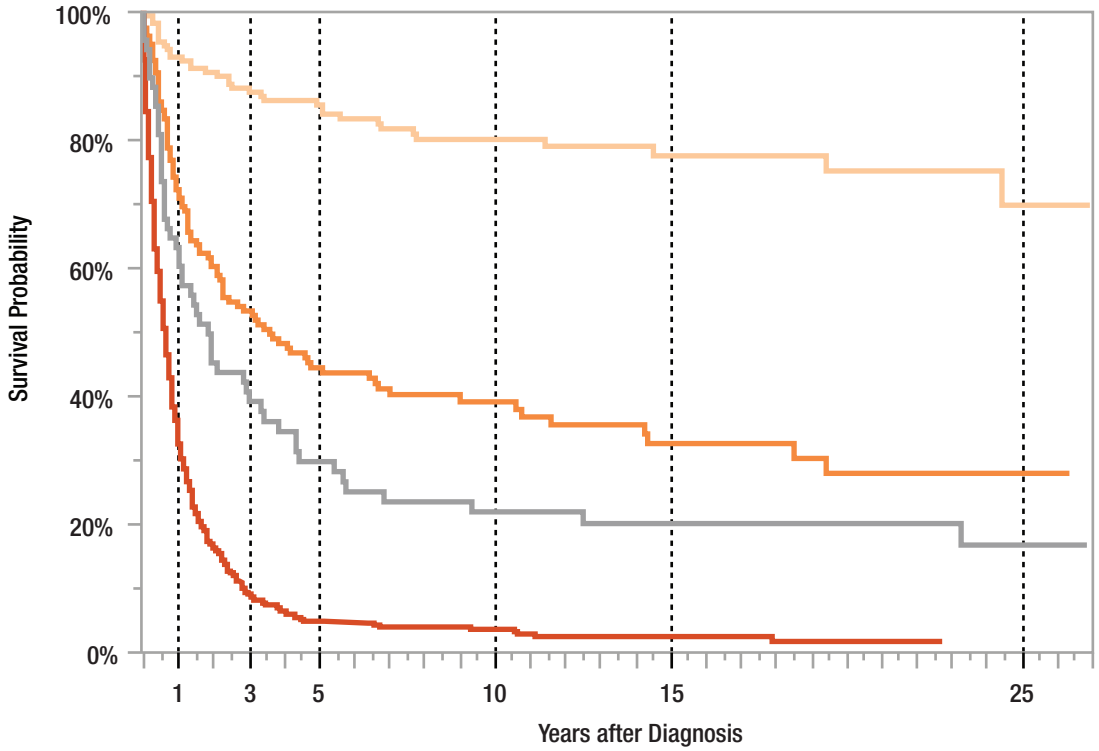
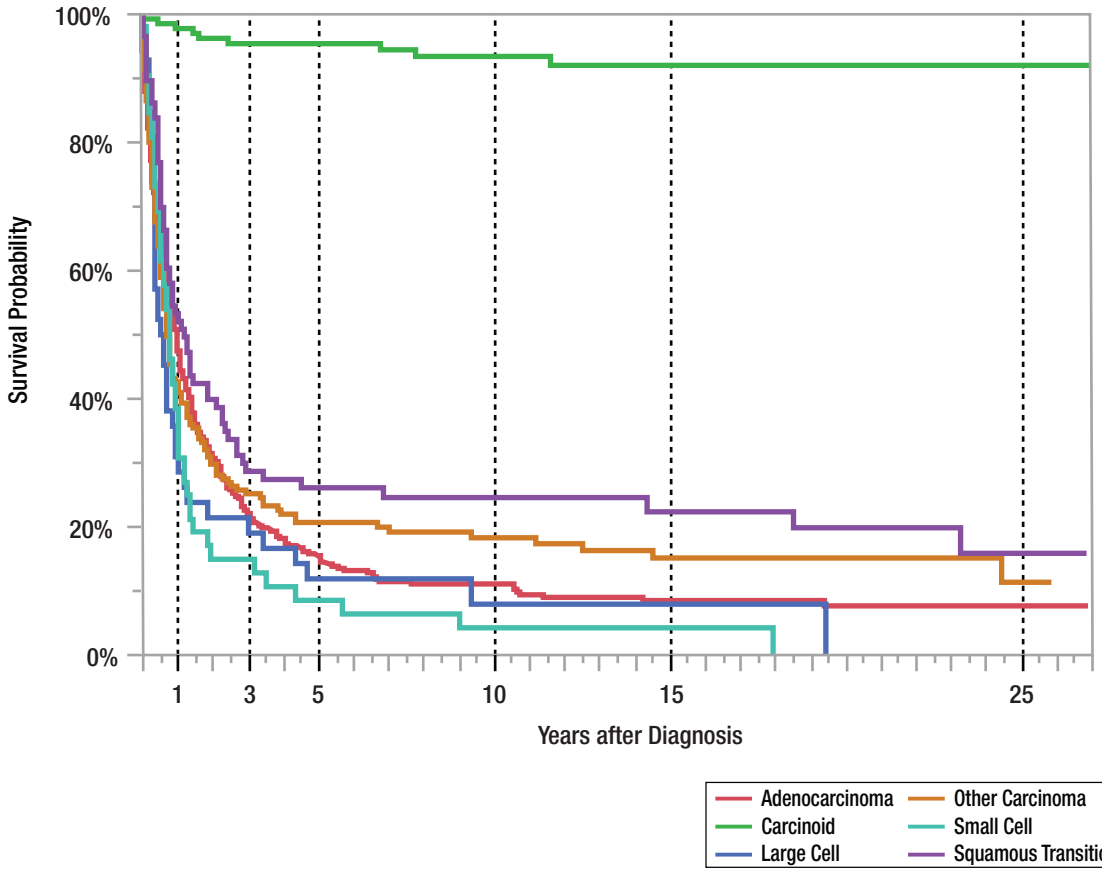


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, LUNG CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 6. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND HISTOLOGIC SUBTYPE, LUNG CANCER, LOS ANGELES COUNTY, 1988-2014



HODGKIN LYMPHOMA

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BACKGROUND

Lymphomas are cancers of white blood cells that are involved in immune function. They usually occur in lymphatic tissue, such as lymph nodes. There are two main types of lymphoma, the more common non-Hodgkin lymphoma (NHL) and the less common Hodgkin lymphoma (HL); NHL is discussed in the following chapter.

HL is a rare cancer of lymphocytes, a type of white blood cell that fights foreign invaders. The unique feature of HL is that the majority of the tumor is comprised of non-cancer white blood cells, while the cancer cells comprise only 1-5% of the total tumor. There are different forms of HL which are largely defined by the non-cancer cells that respond to and surround the cancer cells.

HL is one of the most common cancers among adolescents and young adults (AYAs). High socioeconomic status (SES), high level of education and fewer siblings are risk factors for AYA HL. Although Epstein-Barr virus (EBV), the virus that causes infectious mononucleosis, is a strong risk factor in some types of HL, the EBV-negative nodular sclerosis HL is the most common subtype in the AYA age group.

Standard treatment consists of chemotherapy with or without radiation, depending on stage* and location. With the standard regimen, the cure rate for AYAs has been over 90%. However, severe late effects are common, including breast cancer, thyroid cancer, leukemia, non-Hodgkin lymphoma, and heart, lung and gastrointestinal diseases. These late effects result in a survival rate that continues to decrease long after cure from HL. Recently, new types of treatments have been introduced for AYA patients who do not initially respond to standard therapy. These new drugs, though needing more testing in AYAs, have great promise to improve response and reduce severe late effects.

AYA SURVIVAL IN LOS ANGELES COUNTY

During 1988-2014, a total of 1,553 AYA men and 1,440 AYA women were diagnosed with HL in Los Angeles County (Table 1). The 5-year survival is higher in women (93%) than men (86%) (Table 1). However, in both sexes, survival rates continue to decrease up to 25 years after diagnosis (Figure 1). Patients of all races/ethnicities have a high likelihood of surviving beyond 1 year (96-100%, Table 1), but racial/ethnic differences become apparent at 5 years. Asian/Pacific Islanders and non-Latino whites have the highest 5-year survival (>91%) and Latino whites and blacks have the lowest 5-year survival (83-88%) (Table 1, Figure 3). Survival rates continue to decrease among all races/ethnicities, leveling off among Asian/Pacific Islanders and Latino whites at about 15 years after diagnosis, but continuing to decrease sharply among non-Latino whites and blacks (Figure 3). Survival is consistently higher among the younger compared to older aged AYAs (15-24 vs. 35-39) (Table 1, Figure 2) and among patients of high compared to low SES (Table 1, Figure 4). By stage*, only patients with late stage* disease showed significantly lower survival over time (Table 1, Figure 5).

Nodular sclerosis is the most common subtype, with 2,132 patients, followed by 473 other or unknown types, 353 mixed cellularity subtype, and 36 lymphocyte depletion subtype (Table 1). There are major differences in survival between subtypes, with the 5-year survival highest for nodular sclerosis (92%), intermediate for mixed cellularity (87%), and lowest for lymphocyte depletion (80%) (Table 1, Figure 6). The continued decline in survival decades after diagnosis seen in the AYA HL patients regardless of subtype is most likely because of deaths due to late effects from treatment, and less likely because of death due to the cancer, highlighting the importance of continued advances in AYA HL care.

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

Hodgkin Lymphoma	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*				Histology			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown	Lymphocyte Depletion	Mixed Cellularity	Nodular Sclerosis	Other
Number of Cases	1,553	1,440	<10	1,120	1,338	536	153	312	990	1,473	66	645	707	619	569	430	24	407	1,302	1,055	230	36	353	2,132	473
Percent of Cases	51.9%	48.1%	—	37.4%	44.7%	17.9%	5.1%	10.4%	33.1%	49.2%	2.2%	21.5%	23.6%	20.7%	19.0%	14.4%	0.8%	13.6%	43.5%	35.2%	7.7%	1.2%	11.8%	71.2%	15.8%
1-year survival	95.8%	98.6%	—	98.3%	97.0%	94.9%	96.0%	95.8%	96.6%	97.7%	100.0%	98.9%	97.5%	97.5%	96.6%	94.4%	—	99.0%	99.1%	93.7%	97.7%	91.7%	95.0%	98.6%	92.3%
3-year survival	89.7%	95.8%	—	95.3%	92.0%	88.9%	94.5%	87.6%	91.8%	94.0%	95.5%	96.4%	92.8%	92.7%	92.5%	87.1%	—	95.0%	97.0%	86.0%	94.1%	83.1%	90.6%	94.3%	87.6%
5-year survival	6.2%	93.2%	—	93.0%	88.6%	85.2%	91.3%	83.2%	88.2%	91.4%	95.5%	94.8%	90.1%	89.0%	88.7%	82.8%	—	92.5%	94.0%	82.6%	91.3%	79.8%	87.2%	91.5%	83.2%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

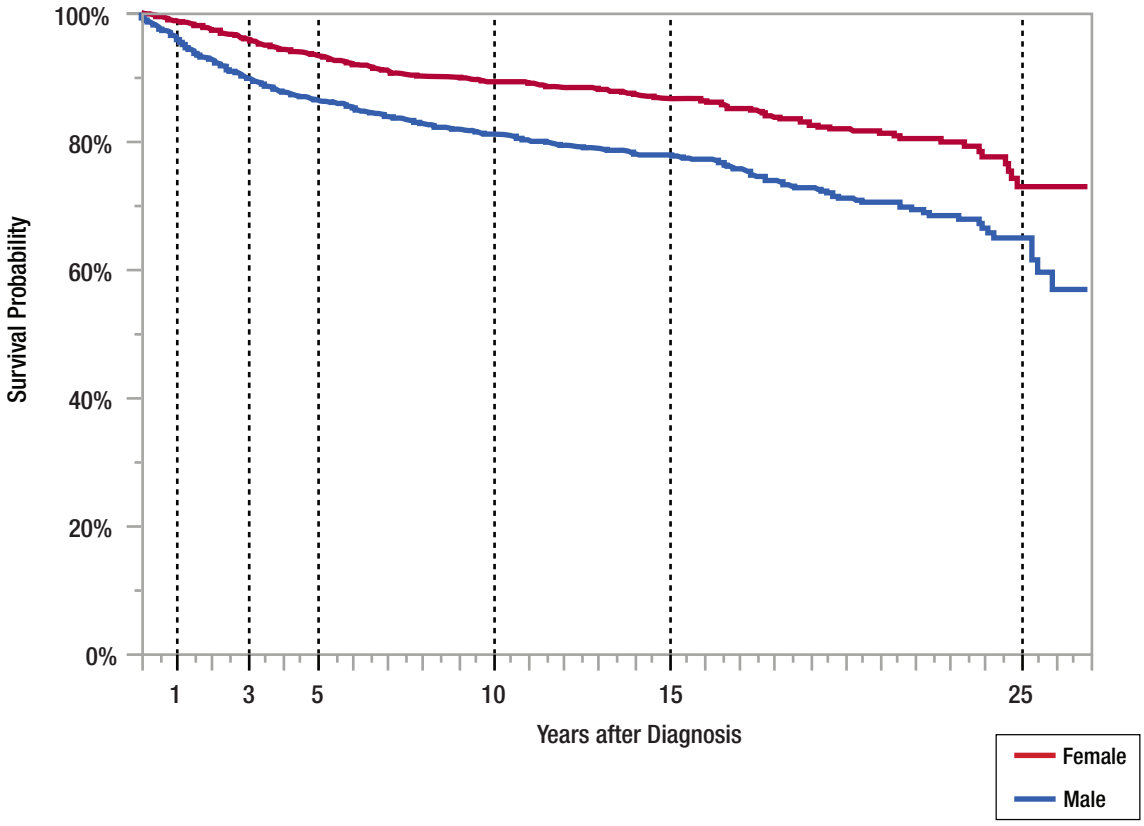


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

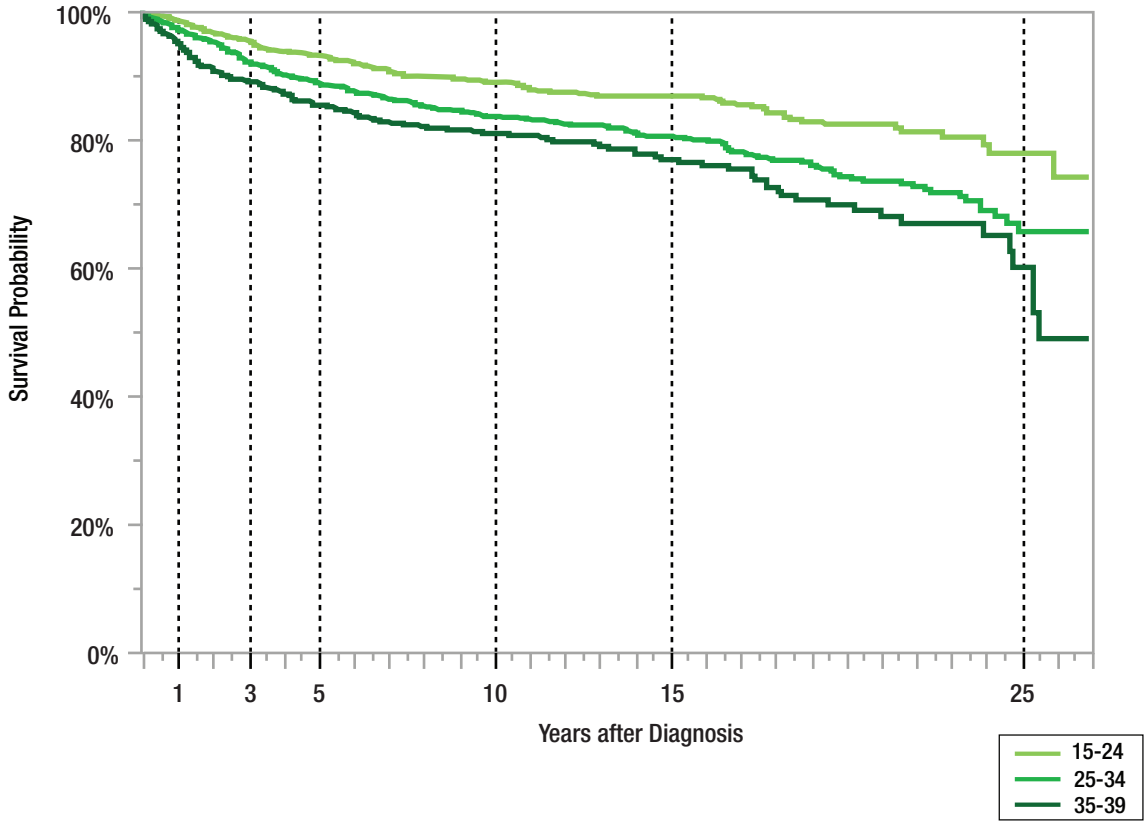


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

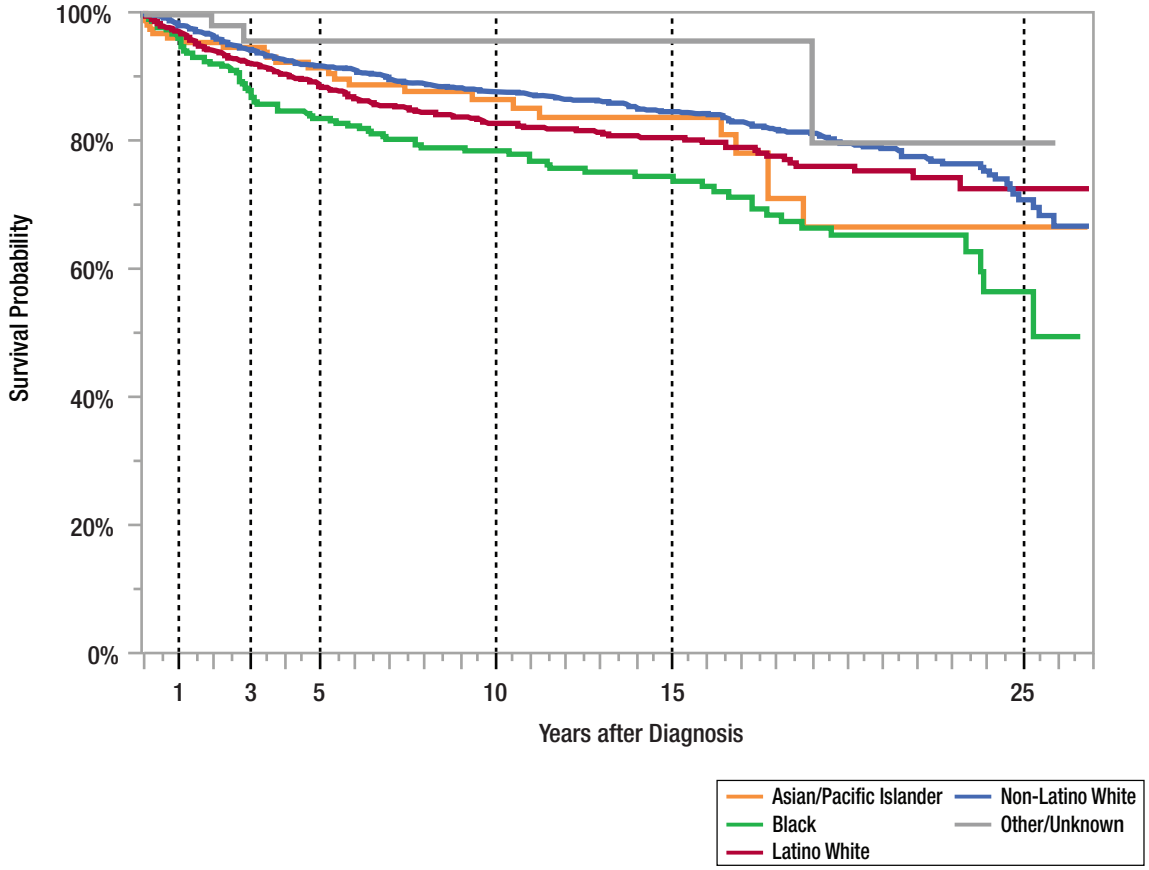


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

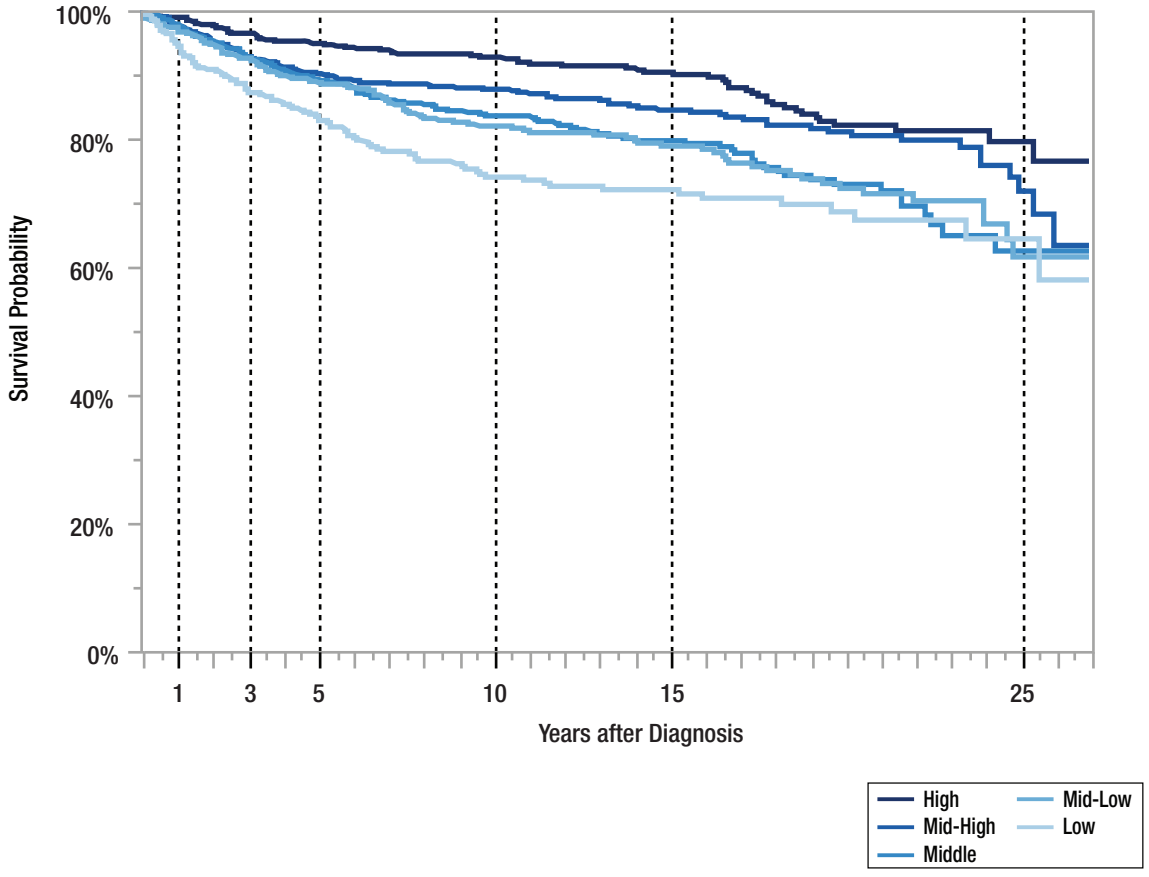
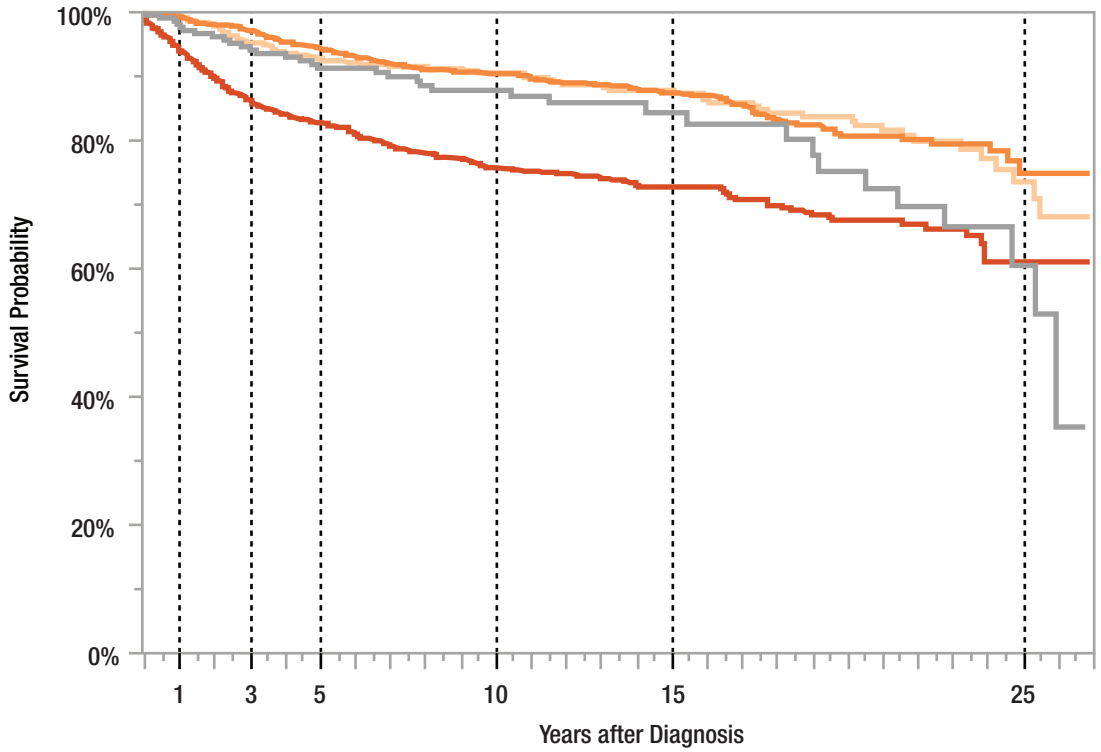
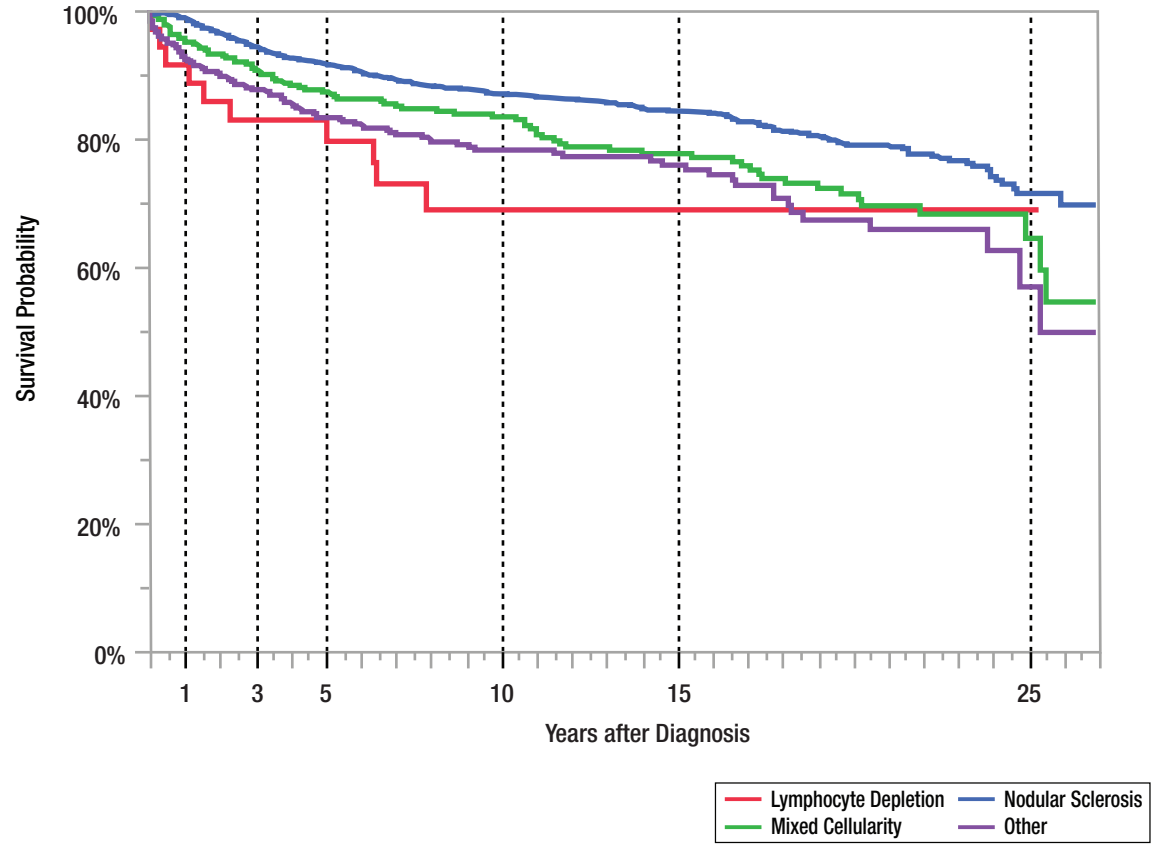


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 6. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND HISTOLOGIC SUBTYPE, HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014



NON-HODGKIN LYMPHOMA

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BACKGROUND

Lymphomas are cancers of white blood cells that usually occur in lymphatic tissue. The two main types of lymphoma are discussed here; common non-Hodgkin lymphoma (NHL) and the less common Hodgkin lymphoma (HL) which is discussed in previous chapter. NHL accounts for 7% of new cancer diagnoses in the adolescent and young adult (AYA) age group. As a cancer of the immune system, risk factors for developing NHL are related to immune function. The most commonly recognized risks include inherited immune diseases, autoimmune diseases, and immune-modulating treatment. AIDS was a leading cause of NHL prior to the introduction of combination anti-retroviral therapy (cART), which has significantly lowered HIV related lymphomas. Other infections, including Hepatitis C, Epstein-Barr virus and Helicobacter pylori, are implicated in specific subtypes of NHL. In the vast majority of cases, no cause is identified.

There are at least 27 different subtypes of NHL, classified by the type and developmental stage of the lymphocyte. Diffuse large B-cell lymphoma (DLBCL) and follicular lymphoma are the two most common NHL subtypes. DLBCL is more aggressive and may be associated with AIDS or previous cancer therapy (especially in older patients), while follicular lymphoma is more slow-growing.

Treatment requires chemotherapy with possible radiation therapy and/or bone marrow transplant. Since the advent of rituximab, a drug that specifically targets certain lymphocytes, survival has significantly improved. A type of immunotherapy is now being explored to unleash the immune system's natural response against cancer and has shown promising results for a subset of patients with NHL.

AYA SURVIVAL IN LOS ANGELES COUNTY

During 1988-2014, a total of 4,489 NHL cases were diagnosed among Los Angeles County's AYA residents (Table 1). Of these patients, men outnumbered women by 2:1. More AYAs are diagnosed with late stage* disease than early stage* disease (45% vs. 27%, Table 1). Overall, NHL survival decreases rapidly in the first years after diagnosis and tapers more gradually beyond 5 years, although it continues to decrease even 25 years after diagnosis. Women have substantially better survival compared to men for each follow-up period (Table 1, Figure 1A). Asian/Pacific Islanders have the highest survival followed by Latino whites and non-Latino whites (similar survival). Black AYA patients have the lowest survival (Table 1, Figure 3A). Those diagnosed under 25 years do substantially better than patients diagnosed at older than 25 years (Table 1, Figure 2A), and those of high socioeconomic status (SES) have much better survival than those of all other SES levels (Table 1, Figure 4A). As expected, patients with early stage* have better survival than those with late stage* disease (Table 1, Figure 5A).

Regarding subtypes, there are twice as many men diagnosed with DLBCL as women. There is less of a difference among follicular lymphoma cases with a man-to-woman ratio of 1.3:1 (Tables 1). Blacks and Latino whites comprise a higher proportion of DLBCL cases (12% vs. 39%) than follicular lymphoma cases (8% vs. 31%) (Table 1). There are differences in distribution by SES as well, with follicular lymphoma diagnoses skewed toward high SES (~50% high or mid-high vs. 31% low or mid-low, Table 1), and DLBCL diagnoses skewed toward low SES (38% high or mid-high vs. 42% low or mid-low, Table 1). Different survival patterns by sex and age are observed for the two subtypes. The pattern for DLBCL is similar to that for all NHL. Men show substantially poorer 5-year survival (52% compared to 74% for women) (Table 1, Figure 1B). Alternatively, survival is quite good for follicular lymphoma in both men and women (5-year survival: 85% vs. 88%) (Table 1, Figure 1C). For DLBCL, younger AYA patients have better 5-year survival compared to older AYA patients (75% vs. 55% for 15-24 and 35-39 year olds Table 1, Figure 2B). In contrast, although the probability of long term survival for follicular lymphoma is high for all AYA age groups, the 5-year survival is higher among the patients aged 35-39 (86%) than among the 15-24 years olds (81%) (Table 1, Figure 2C).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

Non-Hodgkin Lymphoma	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Overall																					
Number of Cases	3,064	1,421	<10	706	2,059	1,724	340	505	1,672	1,856	116	760	977	897	954	862	39	1,227	712	2,002	548
Percent of Cases	68.3%	31.7%	—	15.7%	45.9%	38.4%	7.6%	11.2%	37.2%	41.3%	2.6%	16.9%	21.8%	20.0%	21.3%	19.2%	0.9%	27.3%	15.9%	44.6%	12.2%
1-year survival	57.9%	85.4%	—	81.6%	62.4%	65.1%	80.8%	65.3%	65.0%	64.2%	90.5%	77.9%	66.0%	67.2%	64.0%	59.1%	—	70.5%	78.1%	59.7%	67.2%
3-year survival	48.6%	77.1%	—	71.8%	54.1%	55.7%	70.7%	54.9%	55.5%	55.9%	88.3%	70.8%	57.4%	57.4%	55.0%	48.5%	—	62.9%	68.4%	49.3%	61.3%
5-year survival	45.5%	74.5%	—	69.4%	51.4%	52.3%	68.3%	49.6%	53.3%	52.8%	88.3%	68.3%	54.7%	54.4%	51.9%	45.2%	—	60.8%	66.2%	46.0%	57.1%
Diffuse Large B Cell																					
Number of Cases	890	474	—	252	618	494	118	159	531	535	21	233	280	275	295	272	<10	375	304	600	85
Percent of Cases	65.2%	34.8%	—	18.5%	45.3%	36.2%	8.7%	11.7%	38.9%	39.2%	1.5%	17.1%	20.5%	20.2%	21.6%	19.9%	—	27.5%	22.3%	44.0%	6.2%
1-year survival	66.4%	85.1%	—	86.1%	71.2%	68.2%	76.6%	74.3%	70.1%	74.0%	83.3%	83.8%	73.0%	73.4%	72.4%	63.3%	—	72.7%	86.4%	65.5%	78.1%
3-year survival	54.8%	75.4%	—	76.8%	59.7%	57.1%	65.1%	62.7%	58.4%	63.7%	83.3%	72.0%	64.7%	61.5%	62.3%	49.8%	—	63.6%	75.9%	52.5%	71.8%
5-year survival	52.0%	73.7%	—	75.4%	56.6%	55.0%	61.1%	60.5%	56.7%	60.7%	83.3%	70.1%	62.2%	58.5%	60.2%	46.9%	—	61.3%	74.0%	49.8%	67.7%
Follicular Histology																					
Number of Cases	233	184	—	27	170	220	34	33	130	199	21	92	101	89	80	49	<10	104	60	208	45
Percent of Cases	55.9%	44.1%	—	6.5%	40.8%	52.8%	8.2%	7.9%	31.2%	47.7%	5.0%	22.1%	24.2%	21.3%	19.2%	11.8%	—	24.9%	14.4%	49.9%	10.8%
1-year survival	94.3%	96.7%	—	96.3%	95.2%	95.4%	94.1%	90.9%	96.9%	95.4%	95.0%	97.8%	94.0%	96.6%	90.8%	100.0%	—	98.1%	94.9%	93.6%	97.6%
3-year survival	89.7%	92.0%	—	84.7%	91.9%	90.5%	82.4%	84.8%	92.6%	91.5%	95.0%	95.5%	91.0%	93.0%	85.4%	88.5%	—	95.1%	91.5%	87.3%	95.2%
5-year survival	85.1%	88.3%	—	80.7%	87.8%	86.3%	79.3%	64.7%	90.7%	88.0%	95.0%	93.1%	87.5%	87.9%	77.7%	85.8%	—	92.9%	91.5%	80.4%	92.6%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

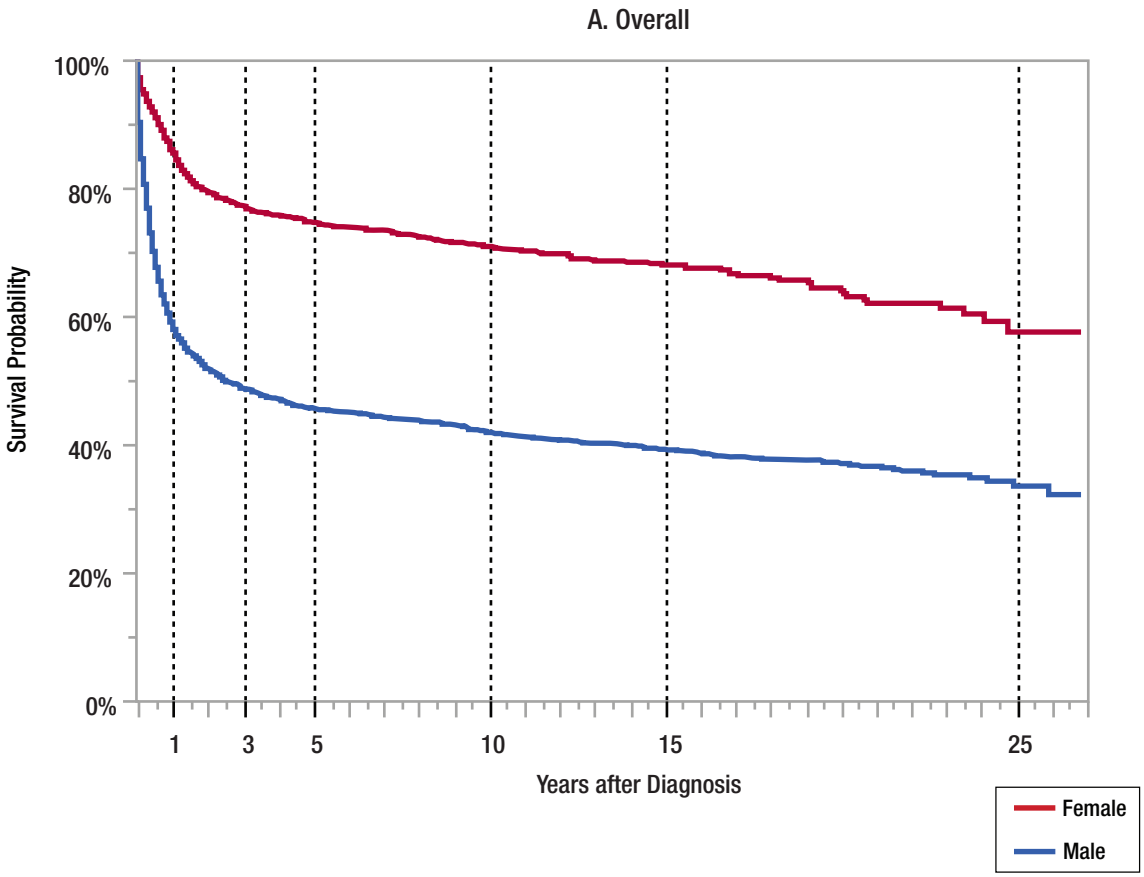


FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

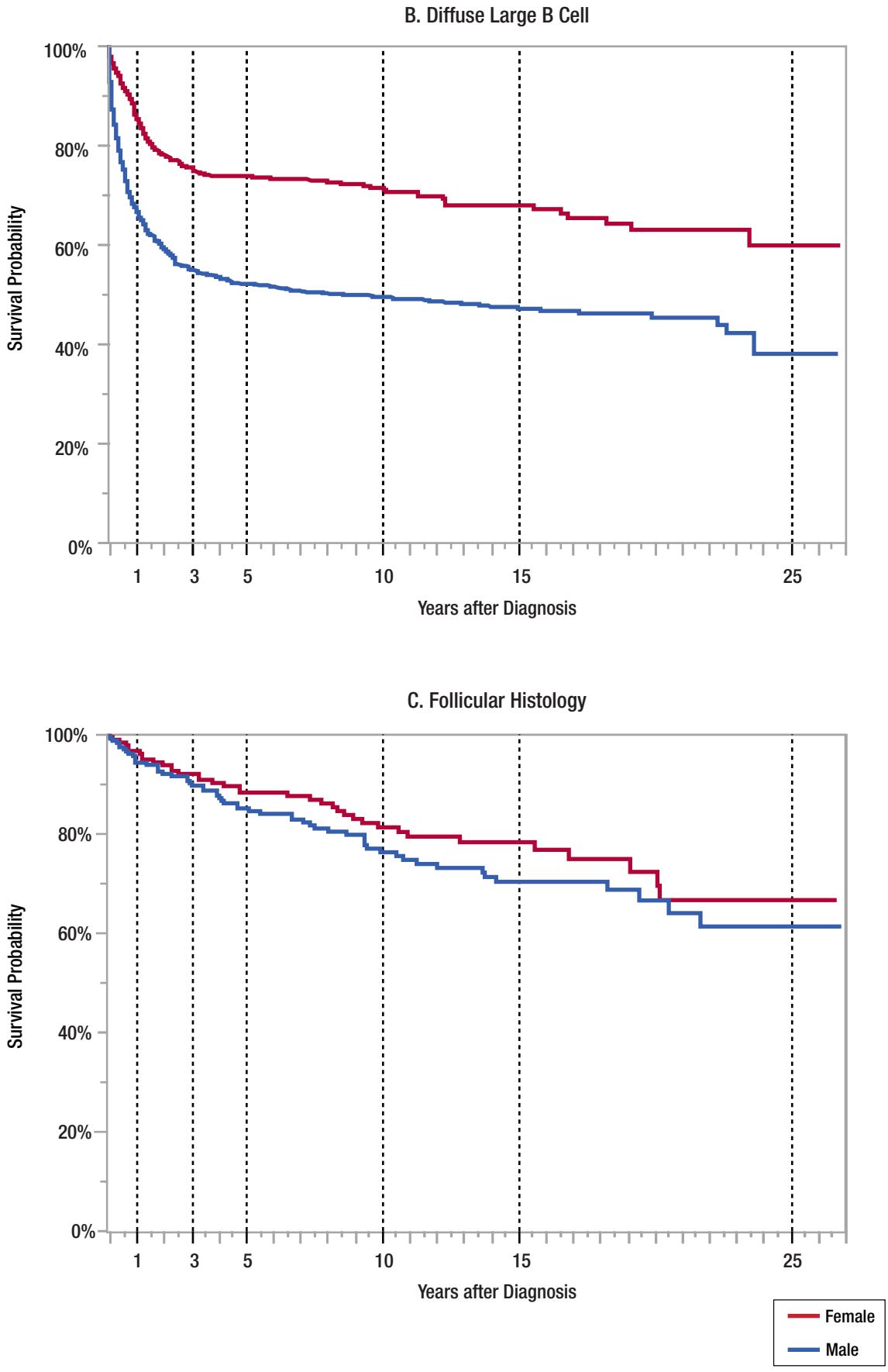


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

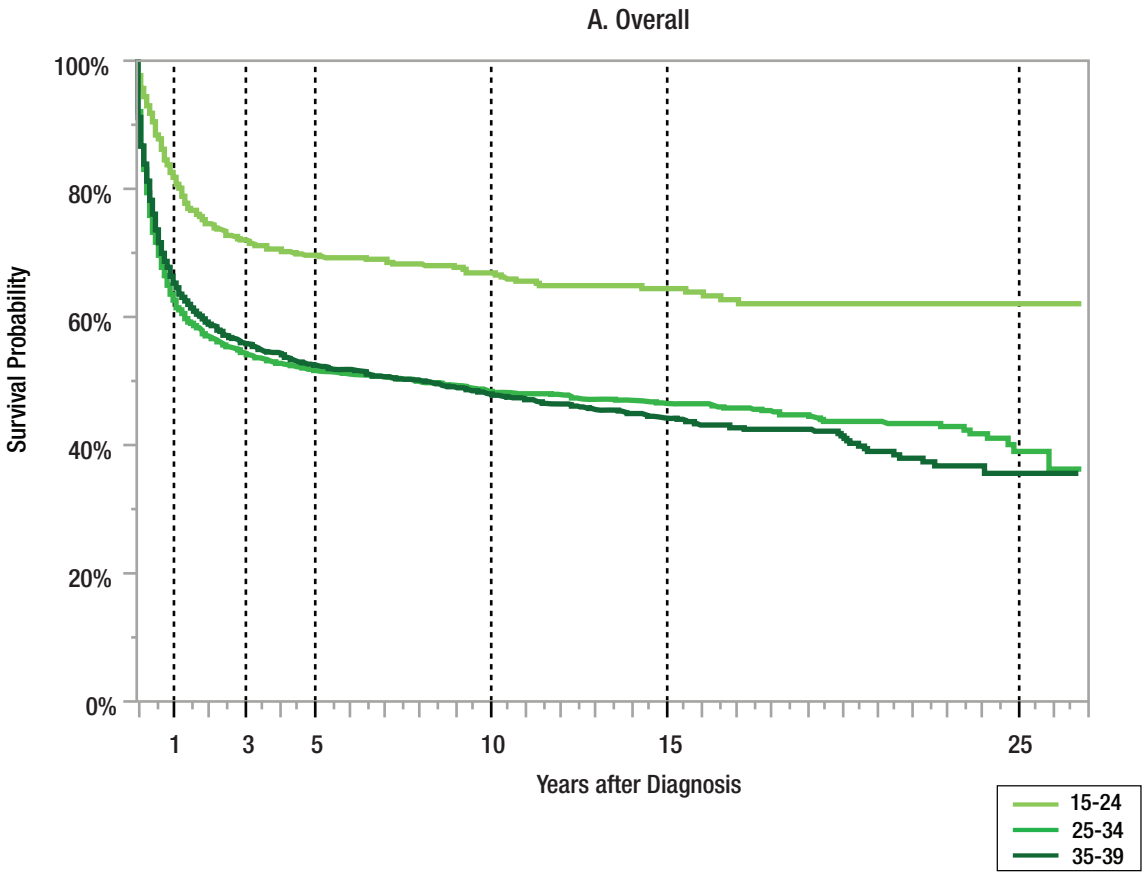


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

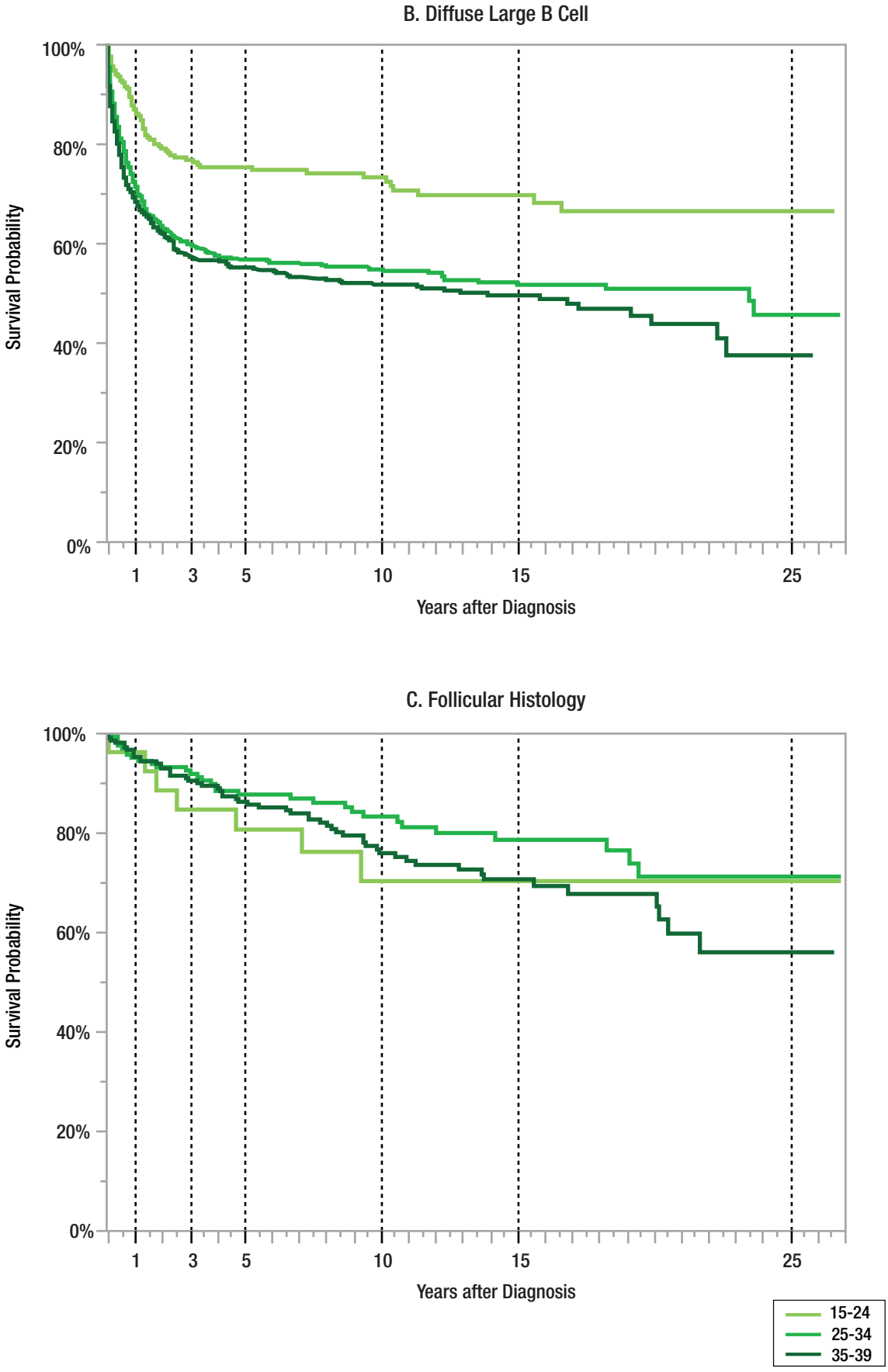


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

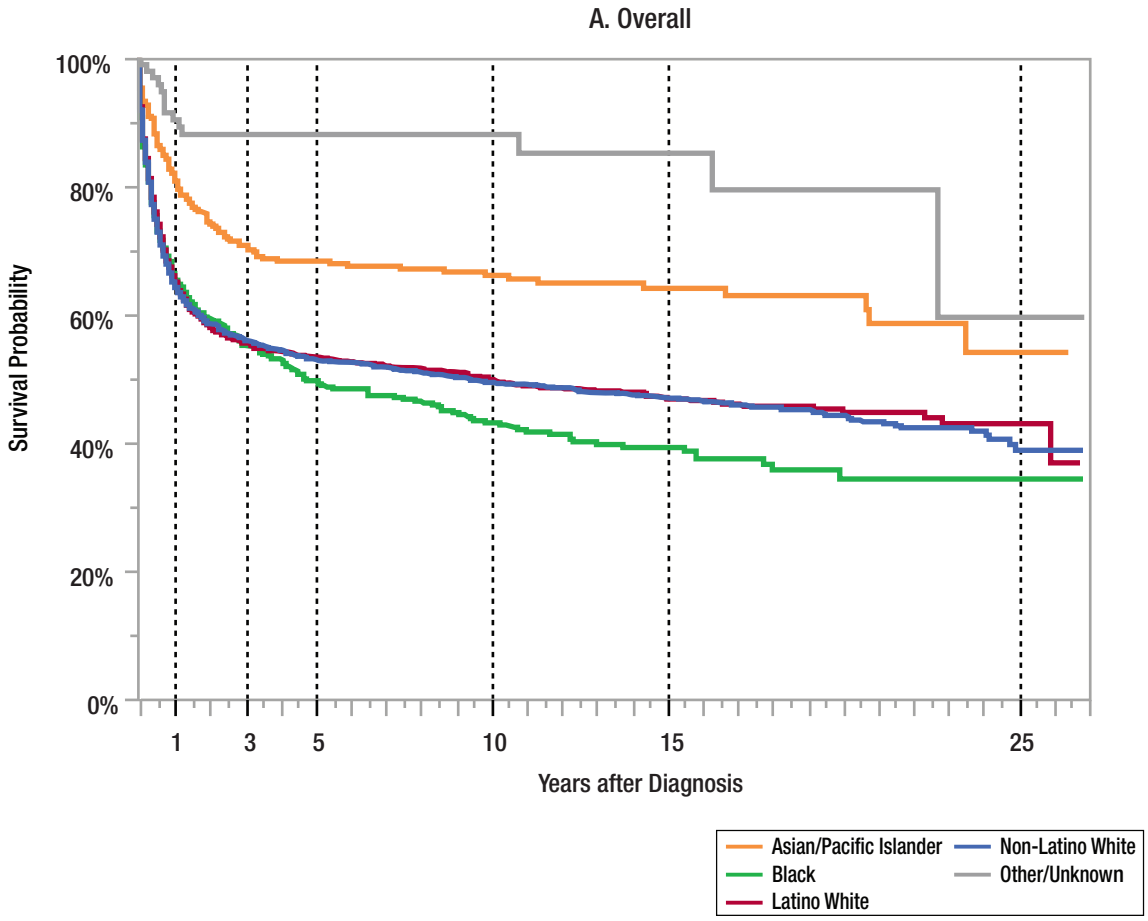


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

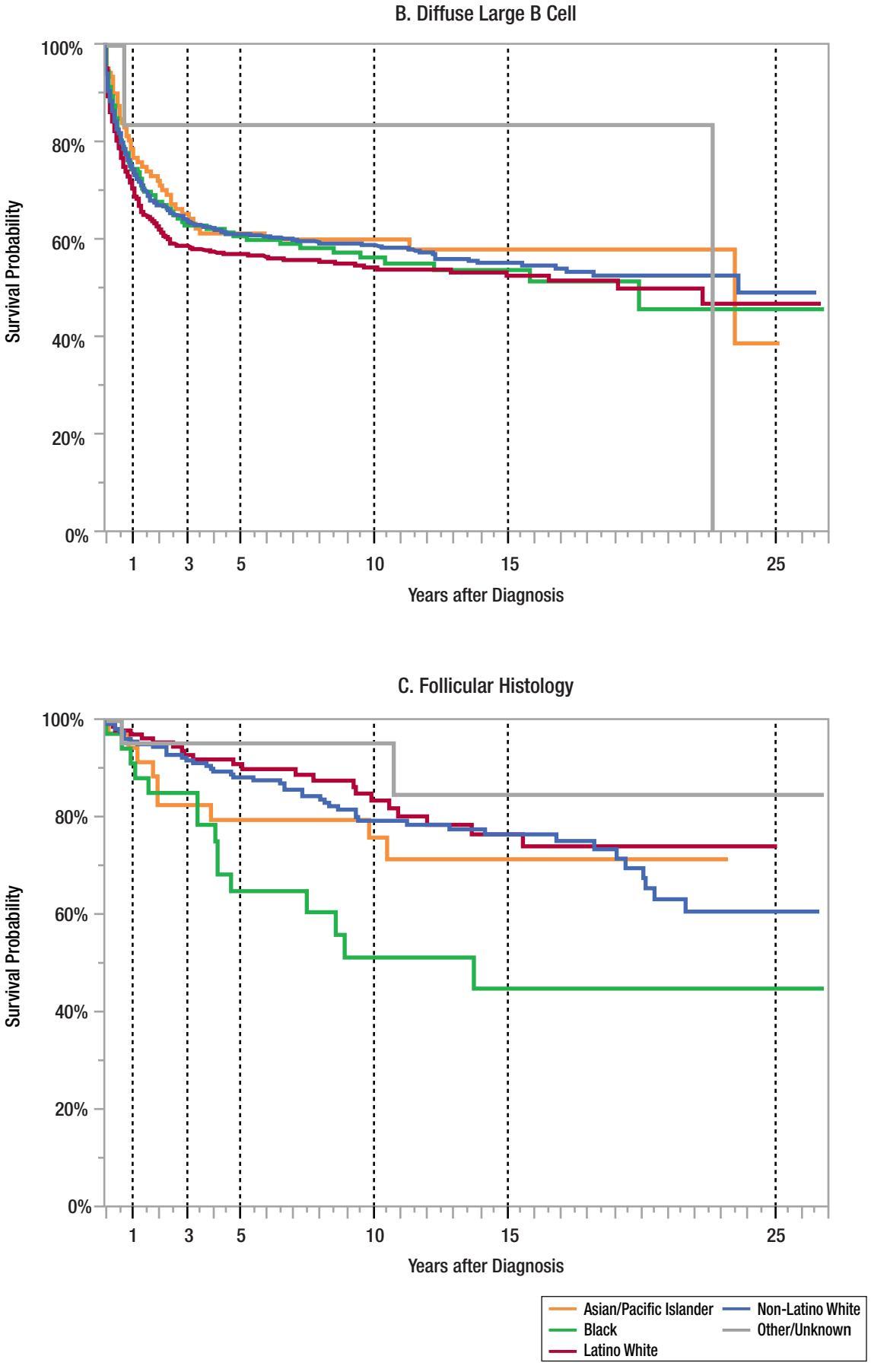


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

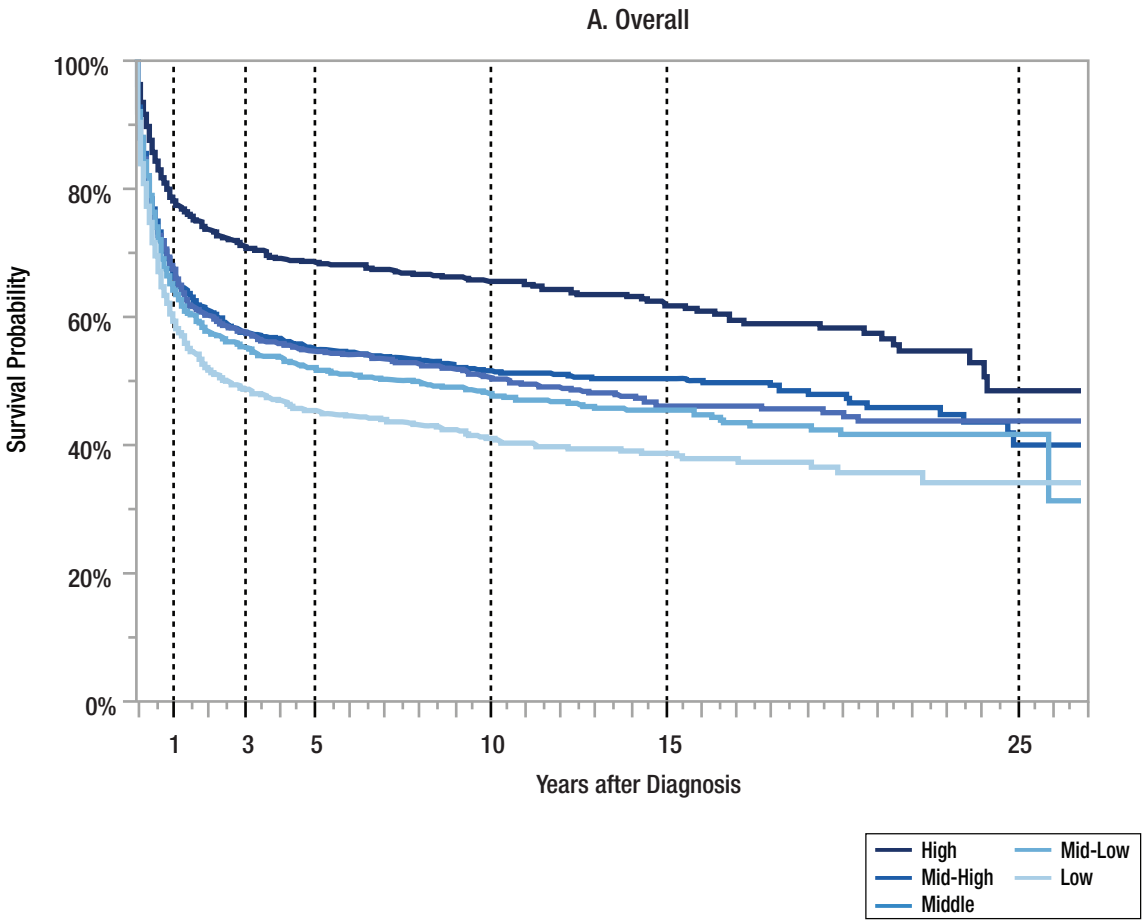


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014

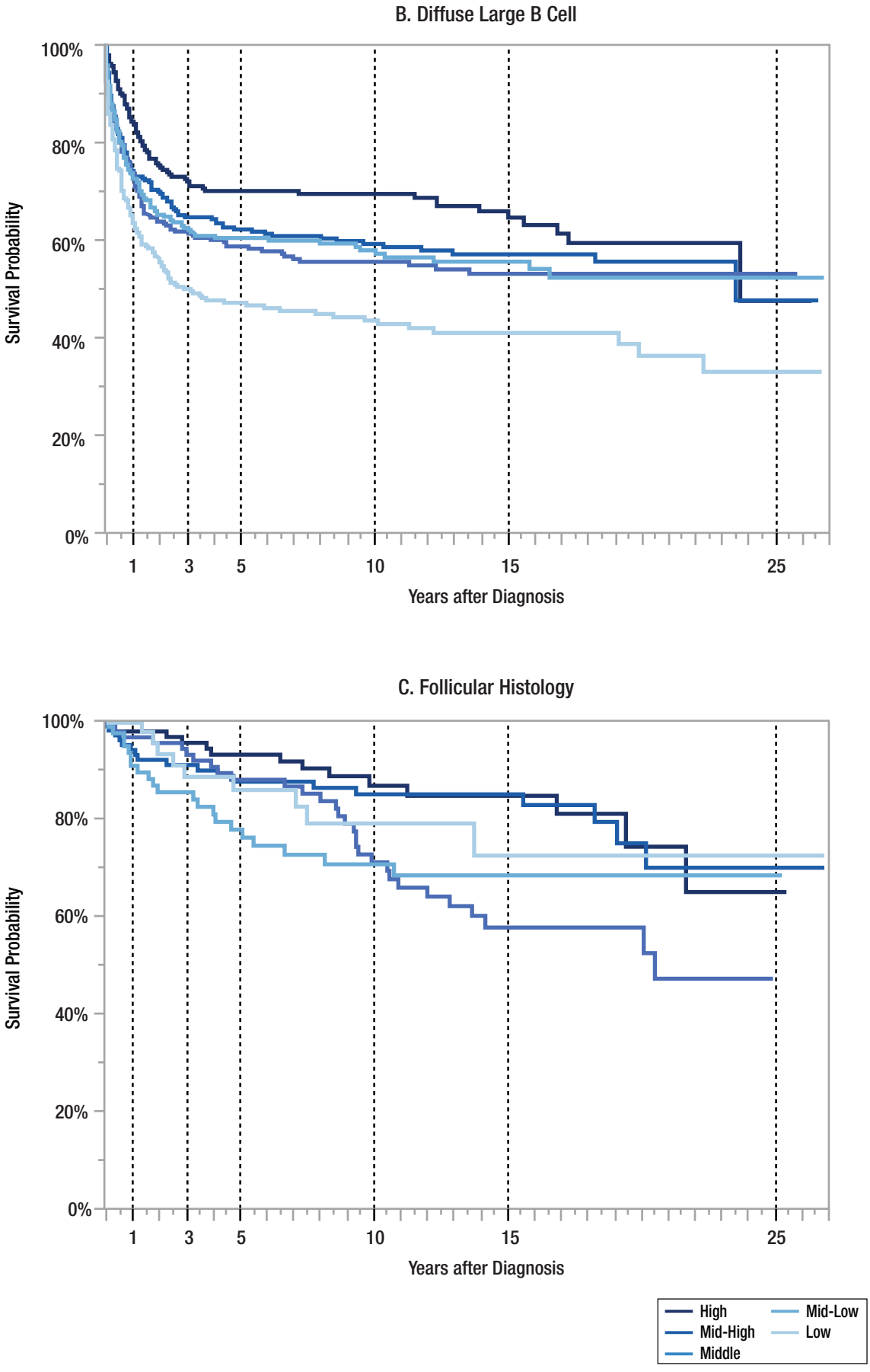
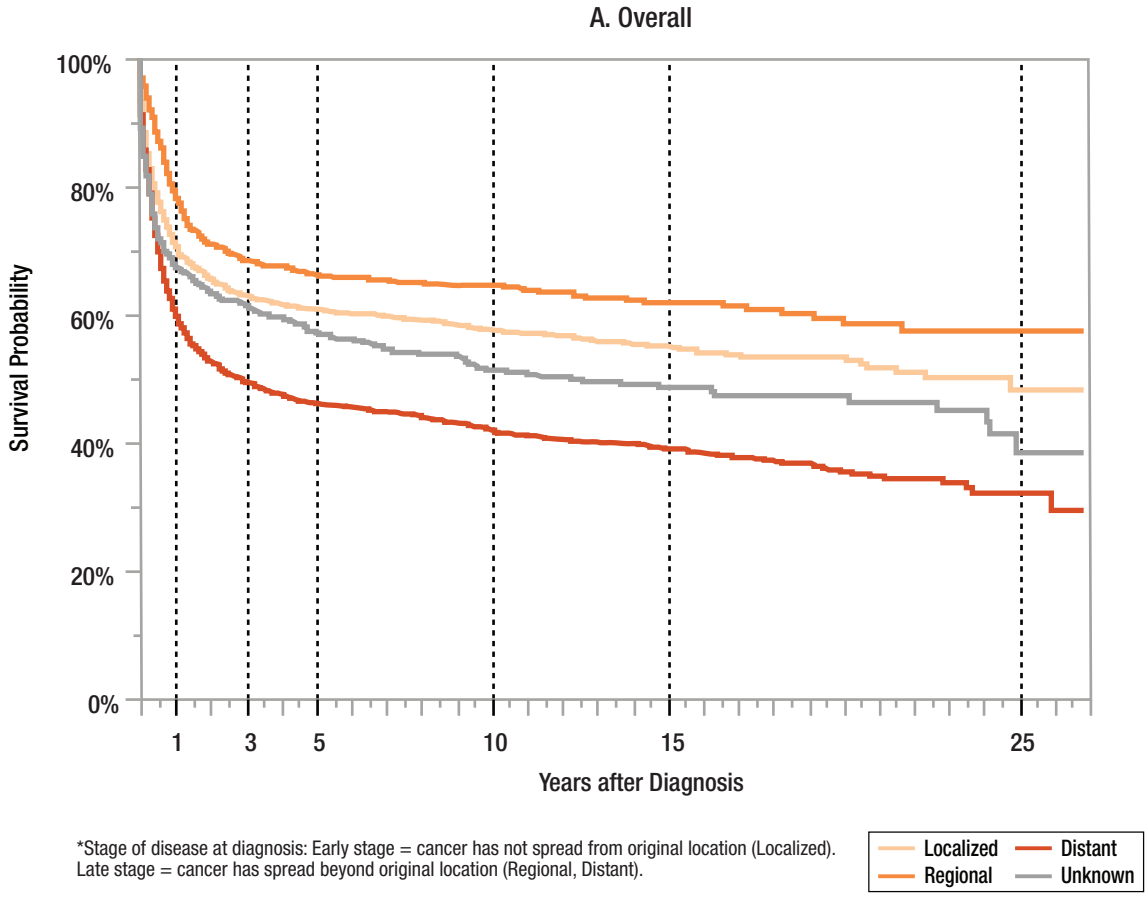
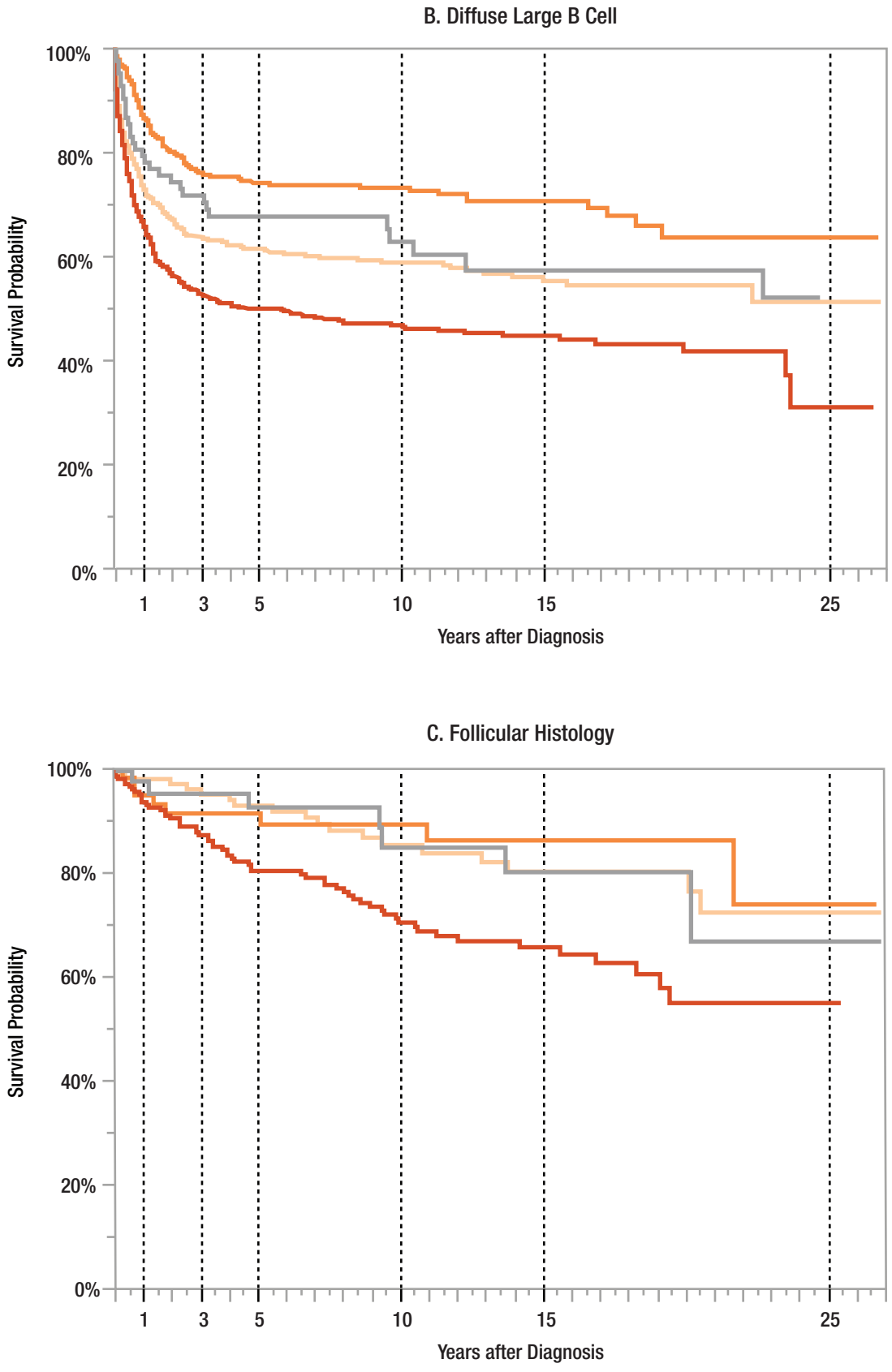


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, NON-HODGKIN LYMPHOMA, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

MELANOMA

Katherine Y. Wojcik, PhD
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Fariba Navid, MD

BACKGROUND

Melanoma is the most serious type of skin cancer, especially if not caught early. Rates of melanoma have been on the rise worldwide for the past thirty years, with the highest rates occurring in New Zealand, Australia and California.

Melanoma is the 4th most common adolescent and young adult (AYA) cancer in Los Angeles County, where 4,490 AYA melanomas were diagnosed in 1988-2014, but incidence rates have been relatively stable since the late 1990s. In the AYA age range (15-39 years), women get more melanomas, but in older people (ages 50 and up), men get more melanomas. These sex differences by age suggest that melanoma risk factors for young people may be different from those for older people.

From studies of melanoma in older people, we know that having a lot of moles, light-colored eyes, skin, and hair, family members with melanoma, as well as sun exposure and indoor tanning, are all risk factors for melanoma. There have not been enough studies among AYAs to fully understand their melanoma risk factors, but there is evidence that sunburns, indoor tanning practices, and early life sun exposure contribute to melanoma in younger people.

Stage at diagnosis is the best way to tell if a person will survive from melanoma, but other things (sex, race/ethnicity, socioeconomic status) can also influence survival. Very few people will survive a late stage* melanoma. This is why it is important for people to check their own skin (preferably once per month) to see if there are any new or unusual moles or growths. These skin checks will help people know what's normal for them. If someone spots something on his or her skin that looks suspicious or has been changing, it is important to have it checked by a doctor.

AYA SURVIVAL IN LOS ANGELES COUNTY

Most of the AYA melanomas diagnosed in Los Angeles County during 1988-2014 occur in women (57%) (Table 1). The 5-year survival rate for men is lower than that for women (87% vs. 94%) (Table 1, Figure 1).

Most AYA melanomas occur in non-Latino whites (77%), followed by Latino whites (12%), Asian/Pacific Islanders (1%) and blacks (1%) (Table 1). Although 5-year survival in all groups is less than 80%, disparities between groups emerge at 1-year after diagnosis. For 5-year survival, Latino whites, Asian/Pacific Islanders and blacks all have lower survival (80-83%) than non-Latino whites (91%) (Table 1, Figure 3).

About half of all AYA melanomas occur at ages 25-34 (49%), followed by ages 35-39 (38%), and ages 15-24 (13%) (Table 1). Survival is over 90% across all AYA age groups up to 5 years after diagnosis. Differences in survival rate among the age groups are subtle afterward, becoming more apparent near the 10-year mark, when survival is still above 80% across age groups (Table 1, Figure 2).

AYA melanoma occurs more frequently at higher levels of socioeconomic status (SES) (36% high, 29% mid-high) than at other levels (18% medium, 9% mid-low, 5% low) (Table 1). Persons in higher SES have better survival at all time points (Table 1, Figure 4). Survival rates in the lowest SES decline more sharply compared to all other groups. Although 5-year survival is 95% for the high SES, it is much lower, only 76%, for the low SES.

While most AYA melanomas are diagnosed at an early stage* (87%), about 9% melanomas are diagnosed at late stage* and another 4% are unknown. Stage* is the strongest predictor of survival. AYAs with early stage* tumors show a 5-year survival of ≥95%, but survival is particularly poor for late stage* when 5- year survival rates are only 9%. Early detection and prevention of melanoma is important for the AYA population.

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, MELANOMA, LOS ANGELES COUNTY, 1988-2014

Melanoma	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	1,938	2,552	<10	587	2,200	1,704	57	33	520	3,478	403	1,595	1,319	816	418	200	143	3,898	287	109	197
Percent of Cases	43.2%	56.8%	—	13.1%	49.0%	37.9%	1.3%	0.7%	11.6%	77.4%	9.0%	35.5%	29.4%	18.2%	9.3%	4.5%	3.2%	86.8%	6.4%	2.4%	4.4%
1-year survival	96.0%	98.4%	—	97.3%	97.3%	97.6%	96.4%	90.1%	93.0%	97.9%	99.3%	98.8%	98.1%	96.1%	96.5%	88.0%	—	99.6%	93.1%	37.4%	92.4%
3-year survival	90.5%	95.5%	—	94.0%	93.3%	93.2%	87.0%	80.1%	86.9%	94.0%	99.0%	96.8%	94.7%	89.4%	90.2%	78.1%	—	97.7%	75.8%	15.1%	75.8%
5-year survival	86.7%	93.9%	—	91.9%	90.5%	90.6%	83.2%	80.1%	83.5%	91.3%	98.6%	95.2%	92.3%	84.6%	86.2%	76.3%	—	95.7%	68.5%	9.3%	68.9%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, MELANOMA, LOS ANGELES COUNTY, 1988-2014

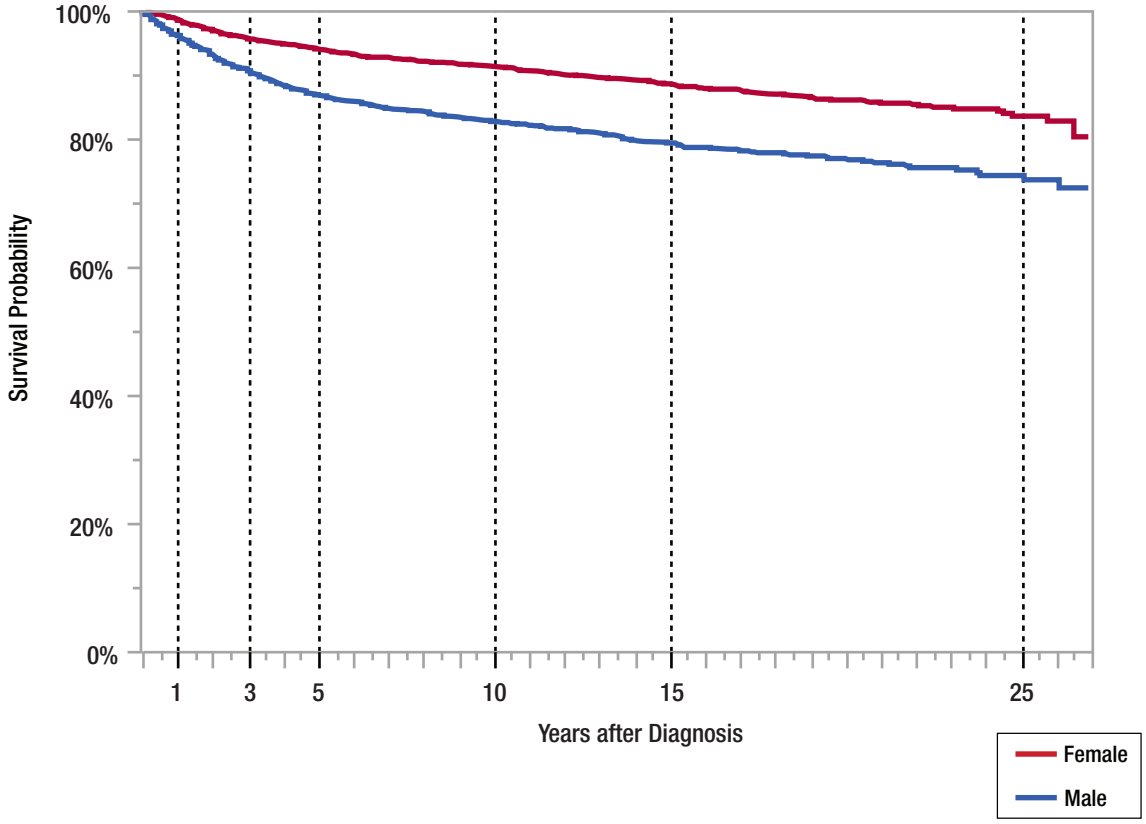


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, MELANOMA, LOS ANGELES COUNTY, 1988-2014

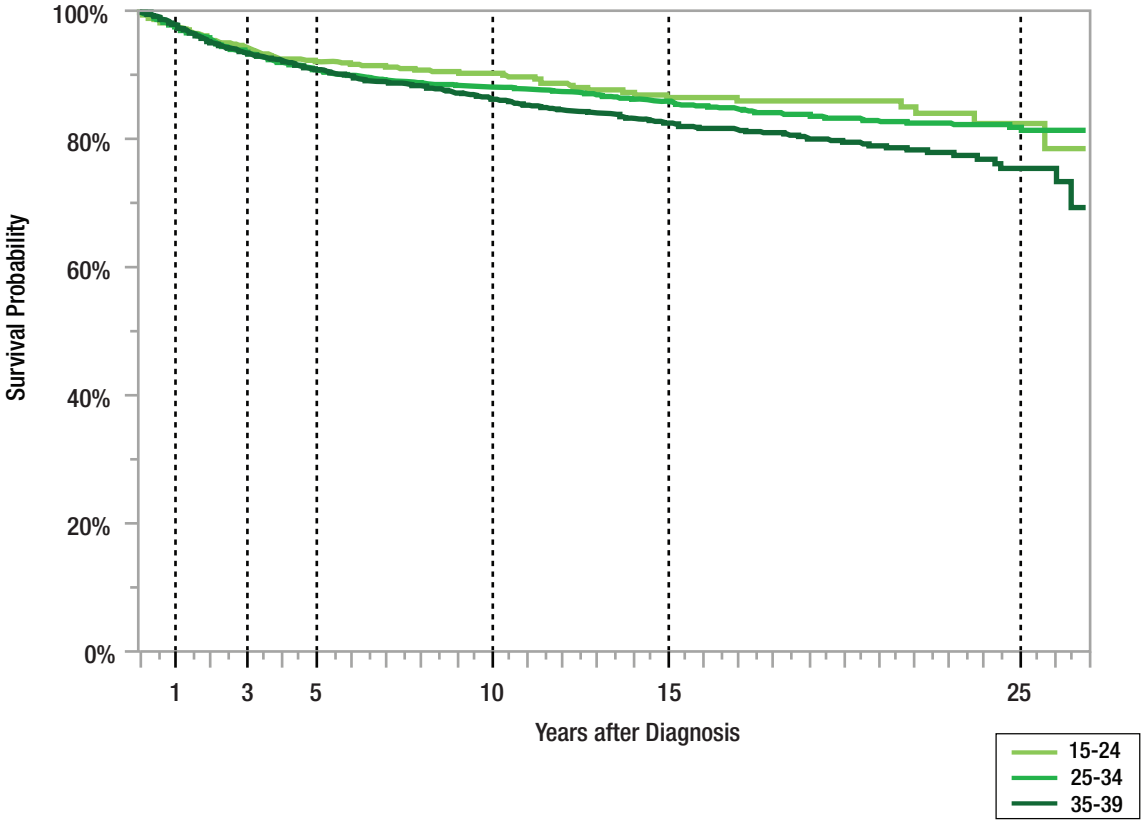


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, MELANOMA, LOS ANGELES COUNTY, 1988-2014

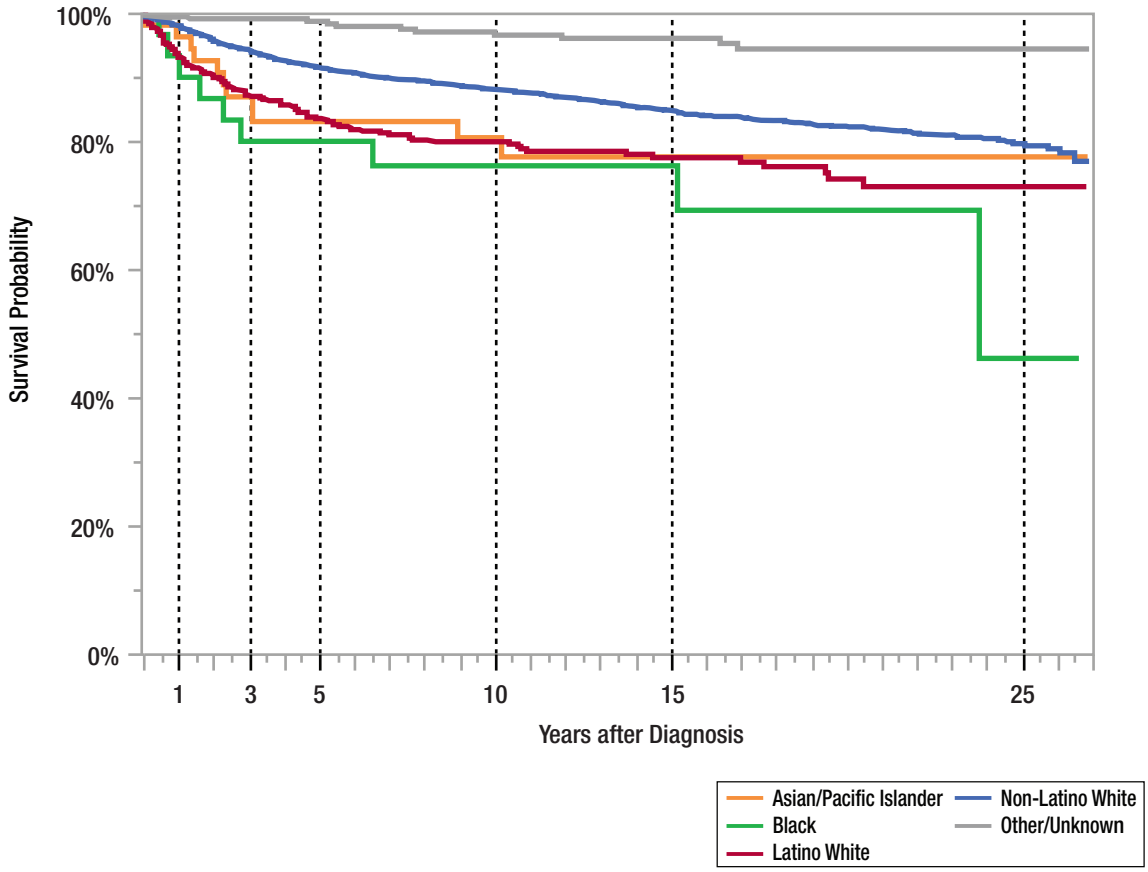


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, MELANOMA, LOS ANGELES COUNTY, 1988-2014

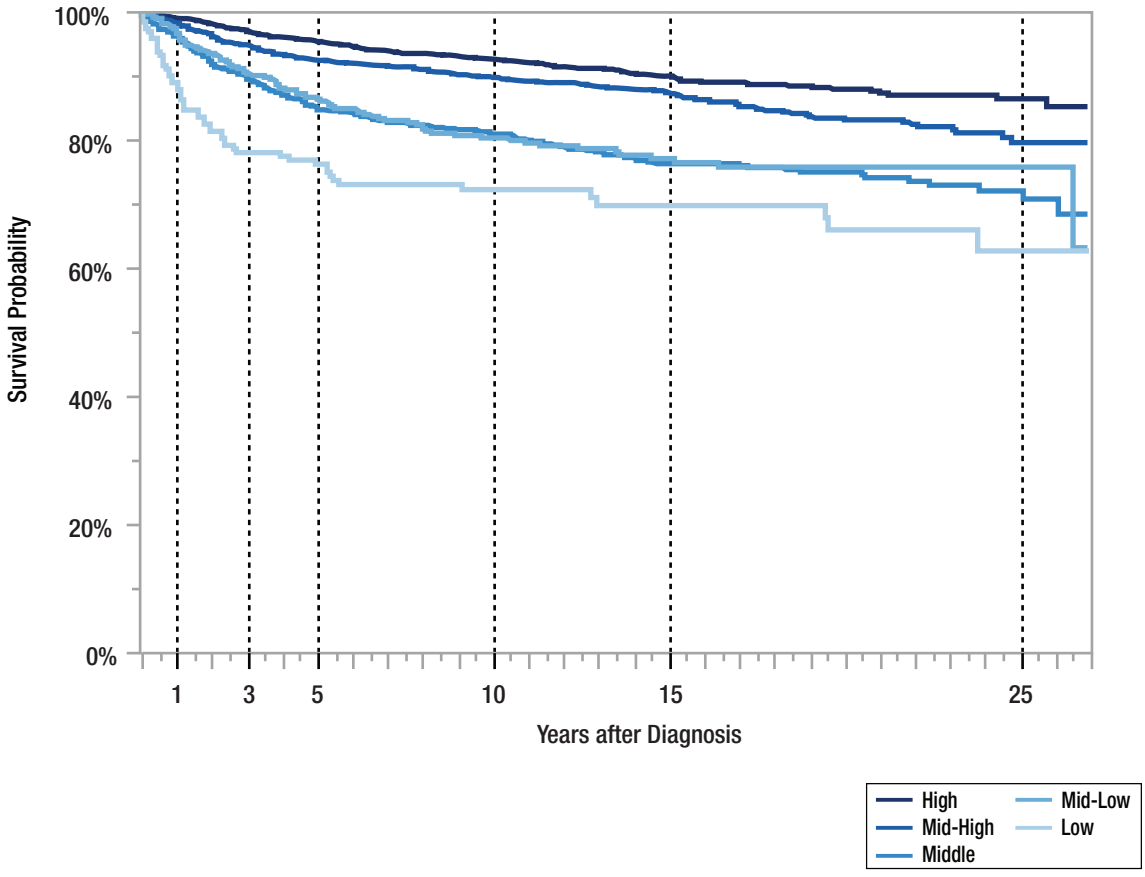
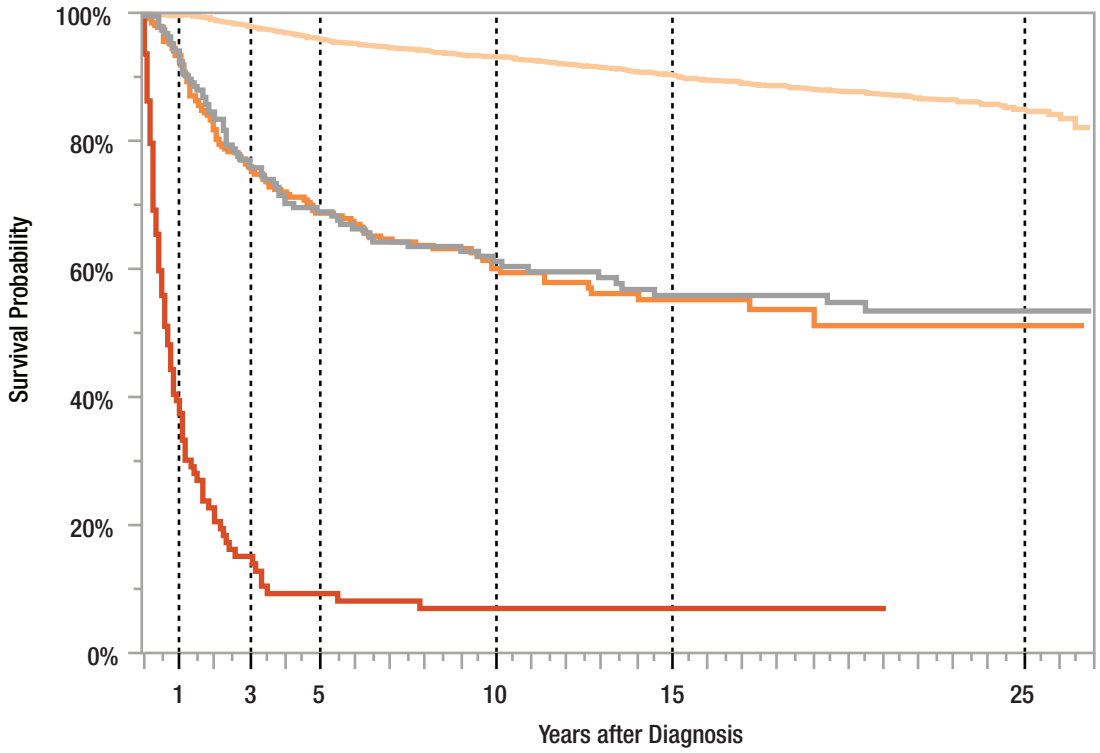


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, MELANOMA, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized).
Late stage = cancer has spread beyond original location (Regional, Distant).

OVARY

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Lynda D. Roman, MD
Stefanie Thomas, MD

BACKGROUND

There are two types of ovarian cancer. The most common type is called ovarian epithelial cancer. A much less common type is ovarian germ cell tumor. Both types of ovarian cancer occur in adolescent and young adult (AYA) women. Younger patients tend to have ovarian germ cell tumors, while older patients more commonly have ovarian epithelial cancer.

Factors that protect against ovarian epithelial cancer are a larger number of childbirths, oral contraceptive use, and tubal ligation ("tubes tied"). Women with a family history of ovarian cancer or endometriosis, regular users of genital talc, and users of estrogen hormone therapy are at increased risk. Although rare, women with changes in major ovarian cancer genes such as BRCA1 and BRCA2 are also at much higher risk of ovarian cancer. In addition, other genetic factors have been identified as having modest influences on risk.

Standard treatment for ovarian cancer includes surgery and chemotherapy for germ cell tumors and surgery and possibly chemotherapy for epithelial cancer. Overall 5-year survival is less than 50%, largely due to the fact that most ovarian cancers are diagnosed at later stage* and only 15% are diagnosed at the early stage*. The 5-year survival rate is 92%, 73%, and 29%, respectively for ovarian cancers diagnosed at the early, regional, and late stage*. Ovarian germ cell tumors have better overall 5-year survival than ovarian epithelial cell tumors at 96%, 87% and 69%, respectively for cancer diagnosed at the early, regional, and late stage*.

AYA SURVIVAL IN LOS ANGELES COUNTY

In Los Angeles County during 1988-2014, the majority of ovarian cancers among AYAs are diagnosed in the older age groups (77% in 25-39 year olds), and less than half of the tumors (44%) are diagnosed at early stage* (Table 1). The 1-, 3-, and 5-year survival rates among AYA women are 91%, 83%, and 78%, respectively (Table 1, Figure 1). For AYA women with early stage* ovarian cancer, the 1-, 3-, and 5-yr survival rates are 99%, 97% and 95%, respectively; the 1-, 3-, and 5-year survival rates drop to 79%, 61% and 53% for AYA women diagnosed with late stage* cancer (Table 1, Figure 5). One of the reasons that survival is more favorable in the AYA population is that younger women tend to have less aggressive tumors and germ cell tumors, the latter are highly curable even at late stage*.

There are hints that survival rates may vary by age, race/ethnicity, and socioeconomic status (SES), but the extent to which this may be due to differences in stage* is unclear. The 5-year survival rates are highest in the youngest AYA women (89% in those aged 15-24), intermediate among those aged 25-34 (81%), and lowest in the oldest AYA women (68% in those aged 35-39) (Table 1, Figure 2). Although the 1-year survival rate is higher in non-Latina whites (93%) than other racial/ethnic groups (ranging from 88% in Asian/Pacific Islanders to 91% in both blacks and Latina whites), the differences in 3- and 5-year survival rates by race/ethnicity are smaller and less consistent (Table 1, Figure 3). Similarly, while AYA women in high and mid-high SES experienced higher 1-year survival rates (94% and 95%) than those in mid-low and low SES (90% and 86%), there are no consistent differences by SES in the 3- and 5-year survival rates (Table 1, Figure 4).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, OVARIAN CANCER, LOS ANGELES COUNTY, 1988-2014

Ovarian Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	—	1,392	—	315	574	503	217	95	592	454	34	235	281	299	297	274	<10	607	267	490	28
Percent of Cases	—	100.0%	—	22.6%	41.2%	36.1%	15.6%	6.8%	42.5%	32.6%	2.4%	16.9%	20.2%	21.5%	21.3%	19.7%	—	43.6%	19.2%	35.2%	2.0%
1-year survival	—	91.4%	—	95.5%	91.5%	88.6%	87.6%	90.5%	90.9%	93.3%	100.0%	93.9%	95.2%	91.1%	90.4%	86.4%	—	98.8%	96.1%	79.4%	96.3%
3-year survival	—	83.0%	—	91.2%	85.6%	74.9%	81.0%	83.7%	82.7%	84.2%	83.2%	85.5%	85.5%	81.4%	83.8%	78.7%	—	96.8%	91.7%	61.4%	88.3%
5-year survival	—	78.2%	—	89.2%	81.4%	68.0%	77.0%	83.7%	76.6%	79.2%	83.2%	79.9%	80.6%	75.0%	80.9%	74.5%	—	94.7%	89.7%	52.9%	69.9%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, OVARIAN CANCER, LOS ANGELES COUNTY, 1988-2014

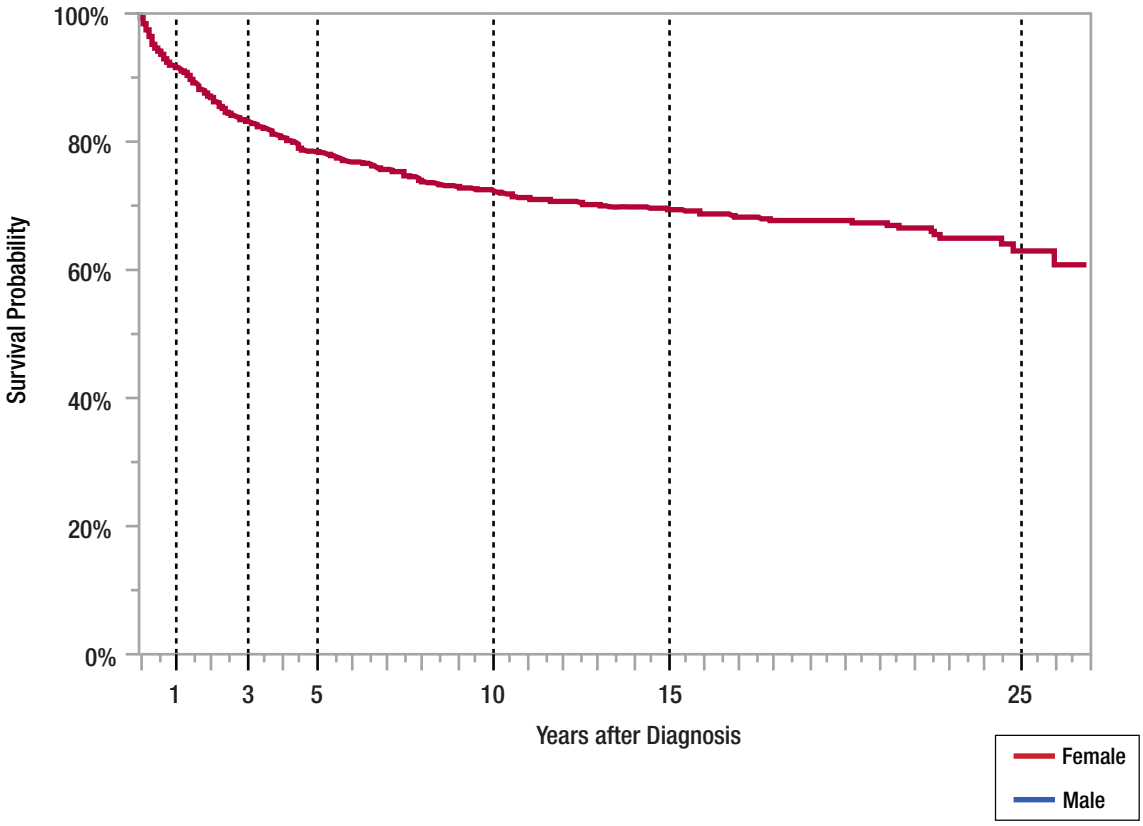


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, OVARIAN CANCER, LOS ANGELES COUNTY, 1988-2014

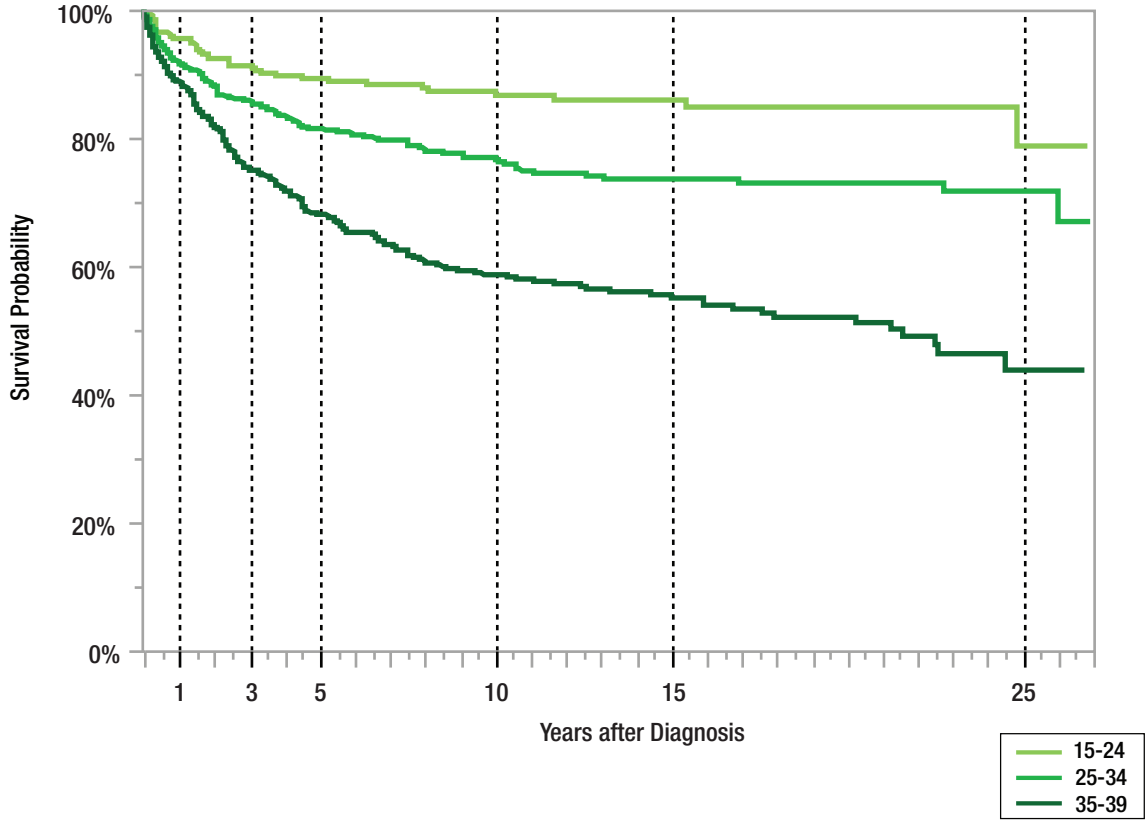


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, OVARIAN CANCER, LOS ANGELES COUNTY, 1988-2014

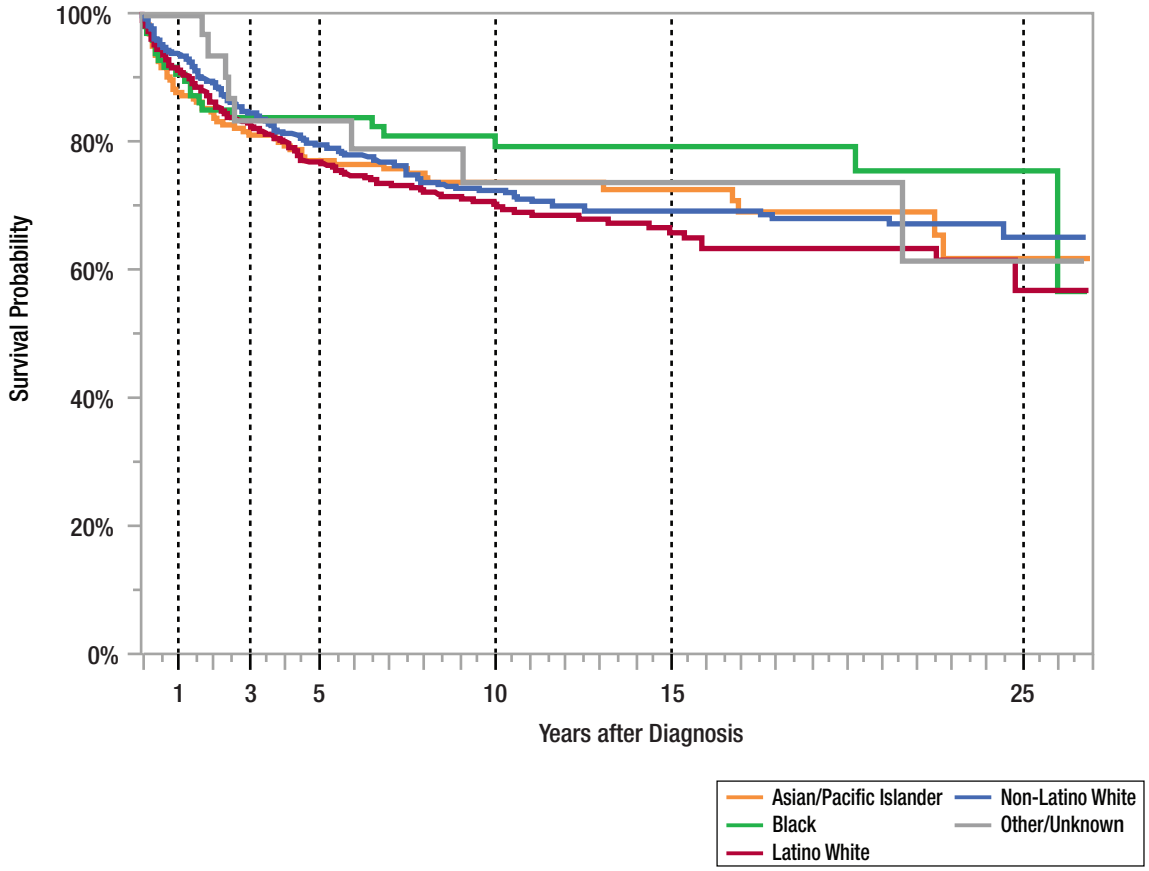


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, OVARIAN CANCER, LOS ANGELES COUNTY, 1988-2014

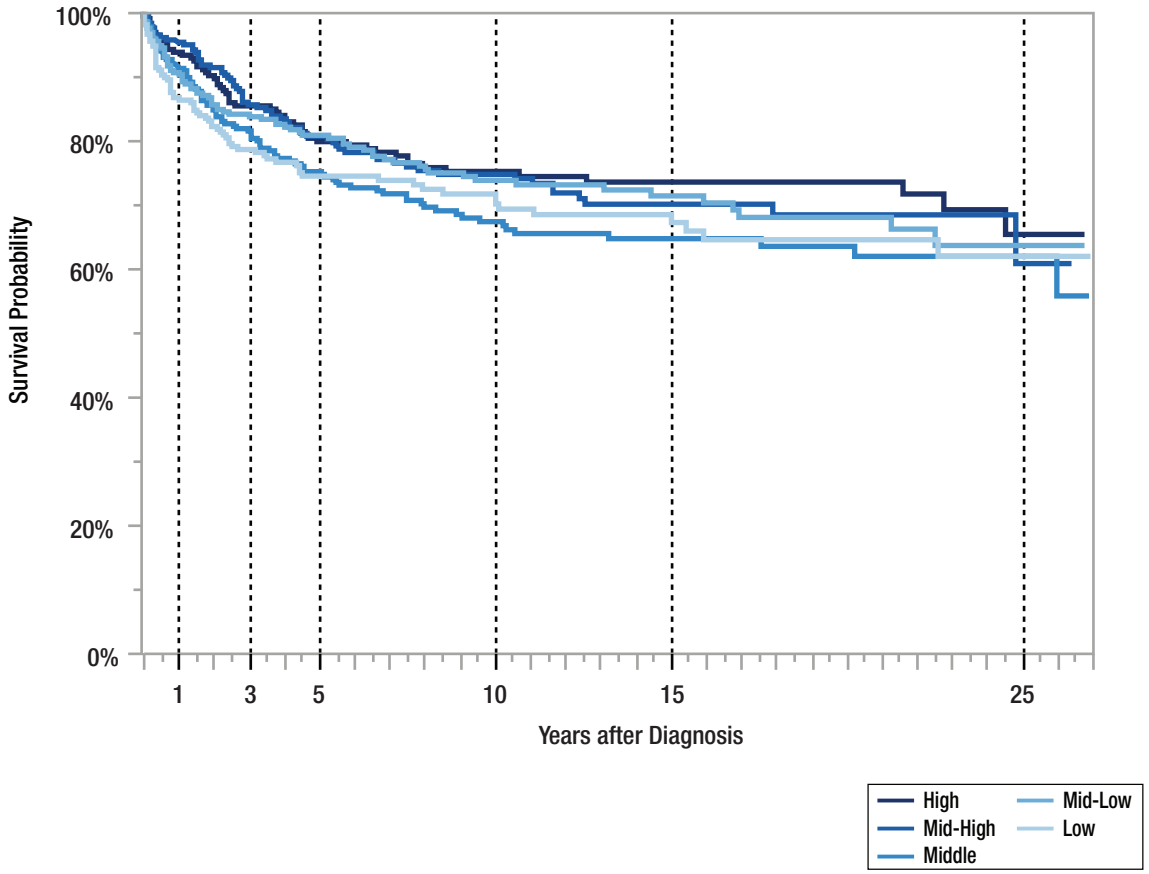
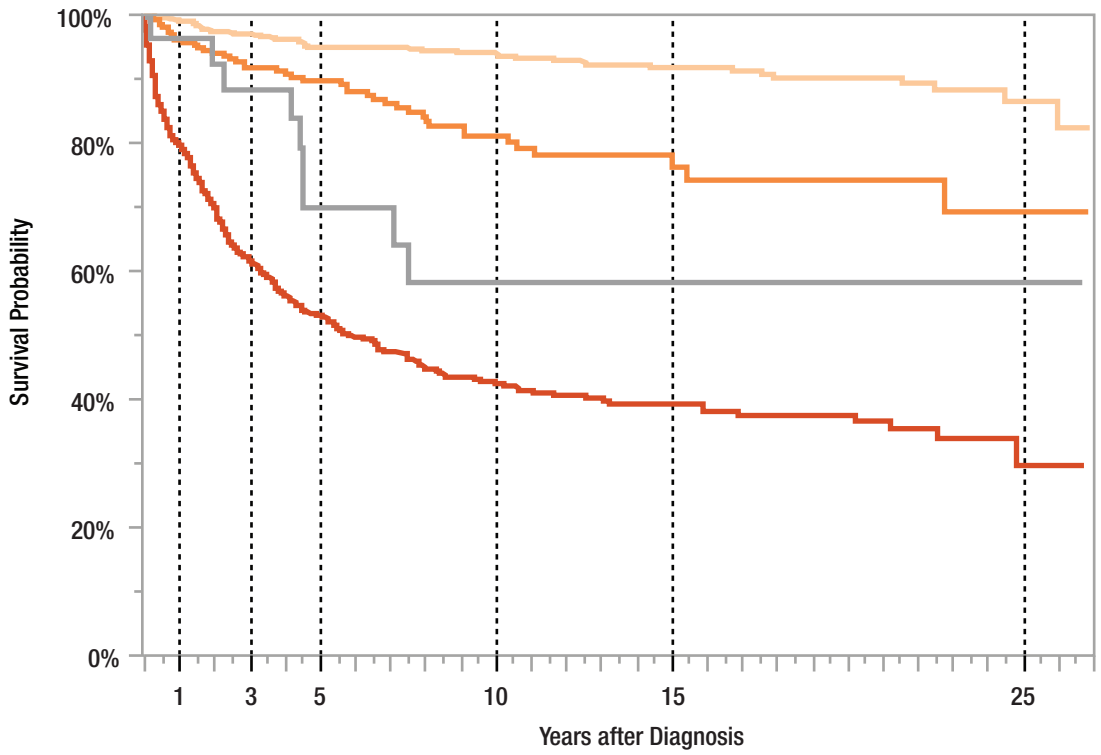


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, OVARIAN CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

STOMACH

Eunjung Lee, PhD
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BACKGROUND

The incidence and death rates of stomach cancer have declined significantly in developed countries during the 20th century, but this cancer remains the 3rd most common cause of cancer death worldwide. Stomach cancer is most common in South Korea and Japan, intermediate in China and parts of Eastern Europe and Latin America, and lowest in Western Europe and the U.S. Stomach cancer usually affects people older than 50 and is rare in adolescents and young adults (AYA), only 2-3% of all stomach cancers are AYA. Overall, stomach cancer is at least twice as common in men as in women, but this difference is not observed among AYA.

Risk factors include infection by the bacteria Helicobacter pylori, high levels of salted food consumption and low levels of fruits and vegetables, smoking, and possibly excessive alcohol. Individuals from families who have changes in certain genes are at a high risk, but these hereditary stomach cancers are very rare. Individuals with minor changes in several other genes are also found to be at a slight to modest increase in risk, although this finding is mainly from older patients.

Survival rates have improved notably since the 1970's, from a 5-year survival rate of 15% in the late 1970's to 31% in the late 2000's. While it remains controversial whether stomach cancer in younger patients is different from older patients, younger patients tend to have more aggressive disease and present at late stage*. Delayed diagnosis in younger patients is likely because early symptoms in younger patients may be thought to be other benign conditions.

Treatment options and guidelines for AYAs are the same as for older adult patients. Patients with early stage* disease are treated with surgery and chemotherapy. Some patients may receive radiation after surgery. Treatment for patients with late stage* disease includes chemotherapy and targeted therapy depending on the specific characteristics of the disease.

AYA SURVIVAL IN LOS ANGELES COUNTY

During 1988-2014 in Los Angeles County, a total of 915 AYA patients, about 50% men and 50% women, were diagnosed with stomach cancer (Table 1). Most are older than 25 years old. About 59% are Latino; 19% are Asian/Pacific Islander. About 54% are of low or mid-low socioeconomic status (SES). More than half of the patients are diagnosed at late stage*, and only 9% are diagnosed at early stage*.

Overall, barely 50% of AYA patients survive beyond 1 year and 20% survive beyond 5 years (Table 1). The survival rate is similar for men and women (Table 1, Figure 1) and across SES groups (Table 1, Figure 4), but substantially different depending on stage* (Table 1, Figure 5). The 5-year survival rates for patients diagnosed at early stage* and at late stage* are 82% and 3%, respectively. Younger age groups experience the worst survival (Table 1, Figure 2). Only 5% of patients diagnosed at age 15-24 survive beyond 3 years. The lowest survival in younger patients is largely due to later stage* at diagnosis. The majority (>90%) of the youngest age group (15-24 years) have late stage* disease, whereas about 50-60% of older patients have late stage* disease (data available upon request). When taking into account this stage* difference, the survival difference across age groups is minimal. Asian/Pacific Islander patients seem to have a little better survival outcome (26% 5-year survival) than other racial/ethnic groups (17-20% 5-year survival) (Table 1, Figure 3). The reasons for this survival pattern are not clear and need to be studied.

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, STOMACH CANCER, LOS ANGELES COUNTY, 1988-2014

Stomach Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	461	452	<10	41	397	477	172	62	540	126	15	100	120	197	230	265	<10	84	262	506	63
Percent of Cases	50.4%	49.4%	—	4.5%	43.4%	52.1%	18.8%	6.8%	59.0%	13.8%	1.6%	10.9%	13.1%	21.5%	25.1%	29.0%	—	9.2%	28.6%	55.3%	6.9%
1-year survival	49.1%	46.0%	—	34.7%	42.1%	52.9%	51.4%	46.5%	44.2%	53.5%	66.7%	52.9%	46.8%	44.9%	48.5%	46.2%	—	91.1%	76.2%	23.2%	62.0%
3-year survival	25.7%	24.4%	—	5.1%	20.6%	29.9%	30.1%	21.4%	24.3%	22.3%	34.3%	25.1%	26.6%	23.5%	24.5%	25.4%	—	84.6%	38.4%	6.6%	36.5%
5-year survival	20.0%	20.8%	—	5.1%	17.7%	23.7%	25.8%	17.5%	19.7%	16.9%	25.7%	21.1%	18.2%	18.8%	20.4%	22.0%	—	81.5%	29.9%	3.0%	34.3%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, STOMACH CANCER, LOS ANGELES COUNTY, 1988-2014

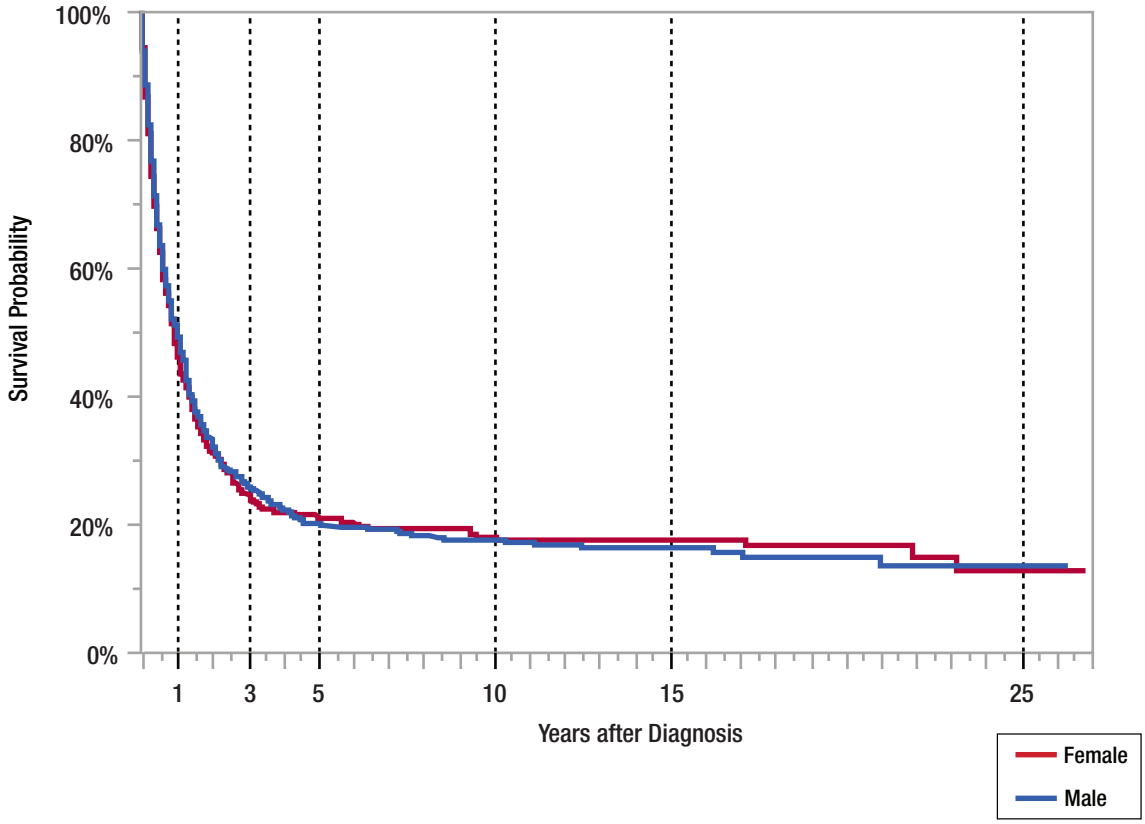


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, STOMACH CANCER, LOS ANGELES COUNTY, 1988-2014

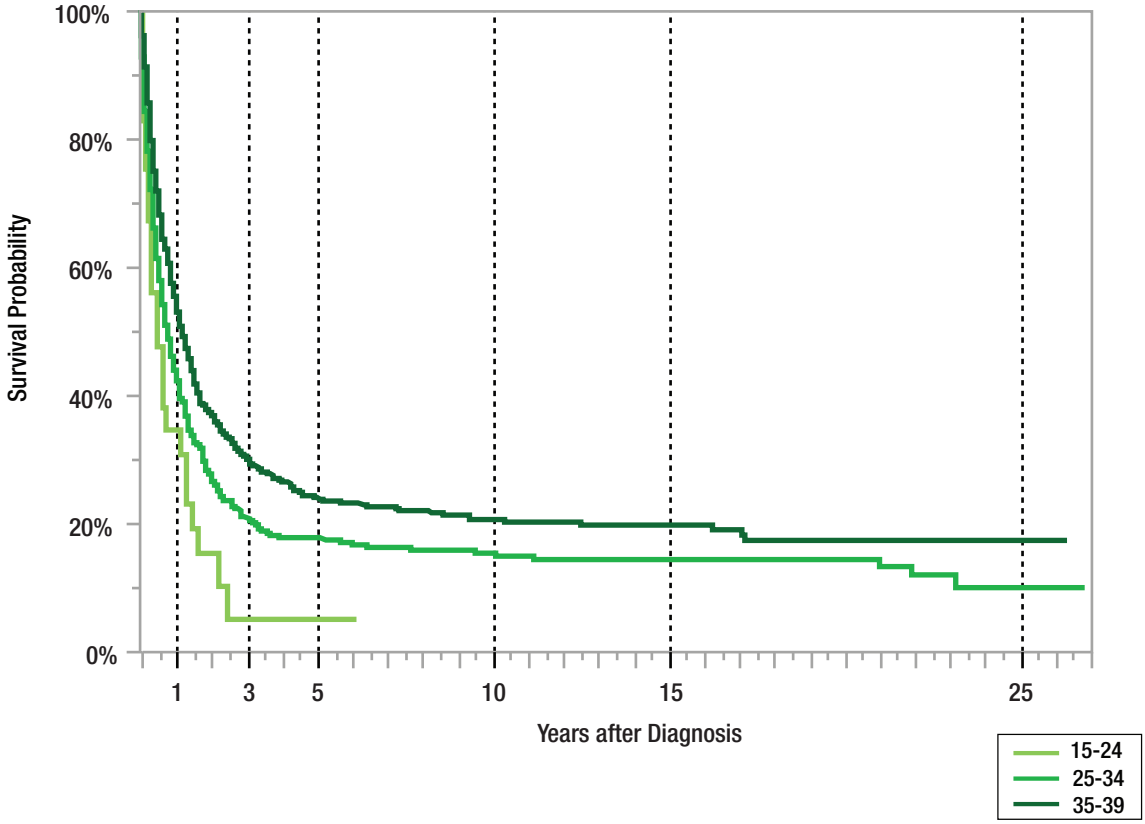


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, STOMACH CANCER, LOS ANGELES COUNTY, 1988-2014

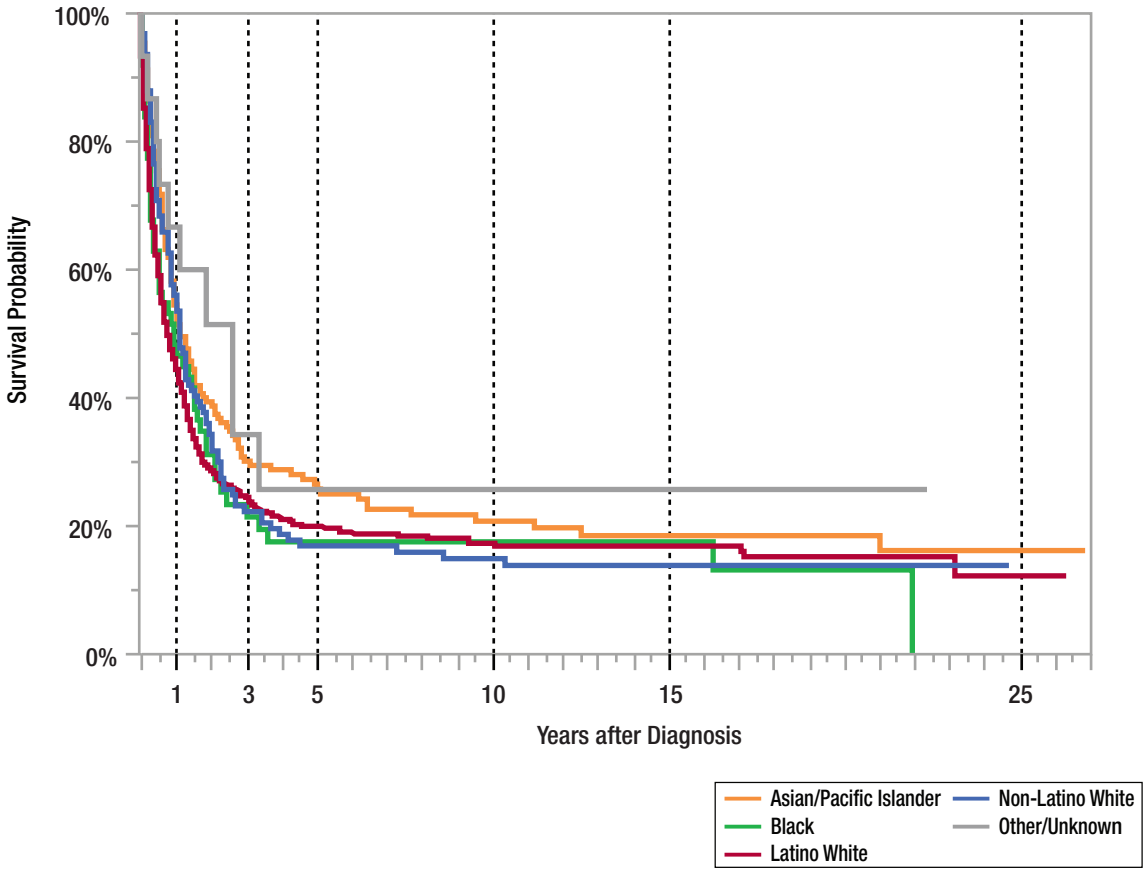


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, STOMACH CANCER, LOS ANGELES COUNTY, 1988-2014

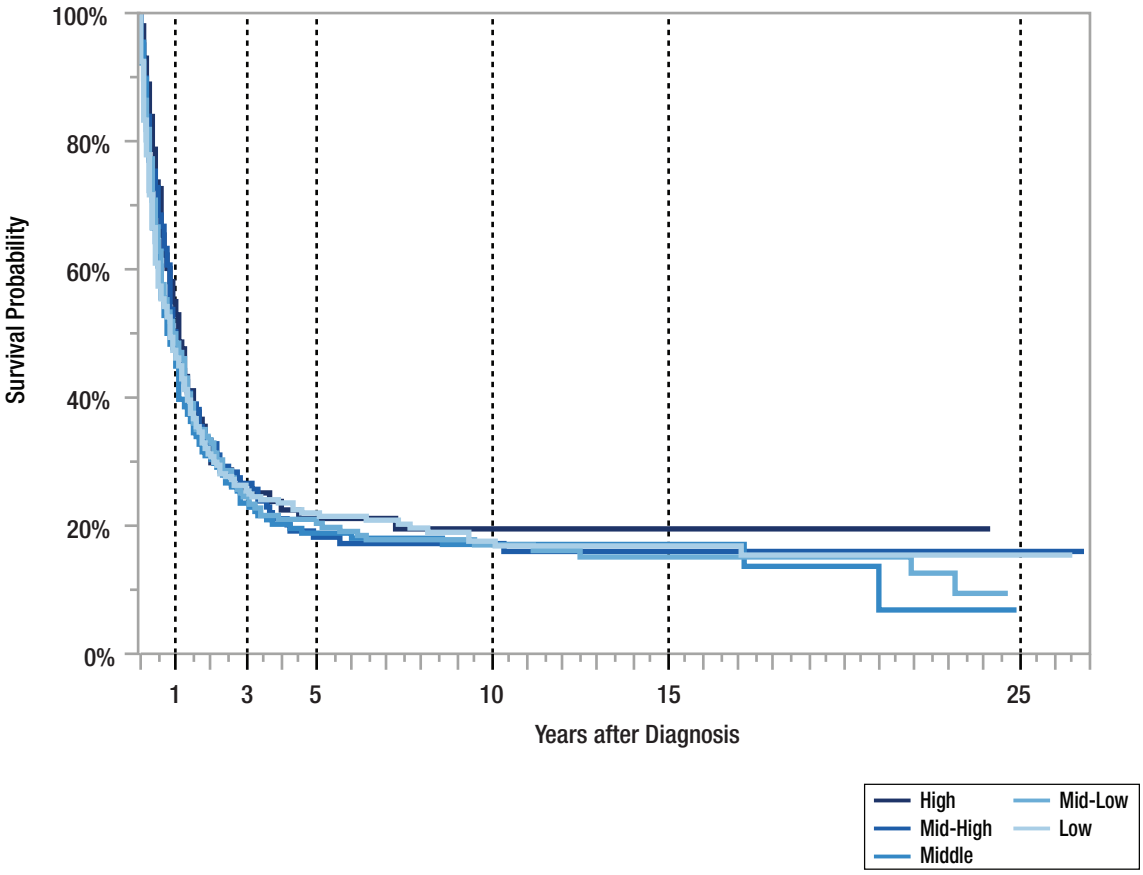
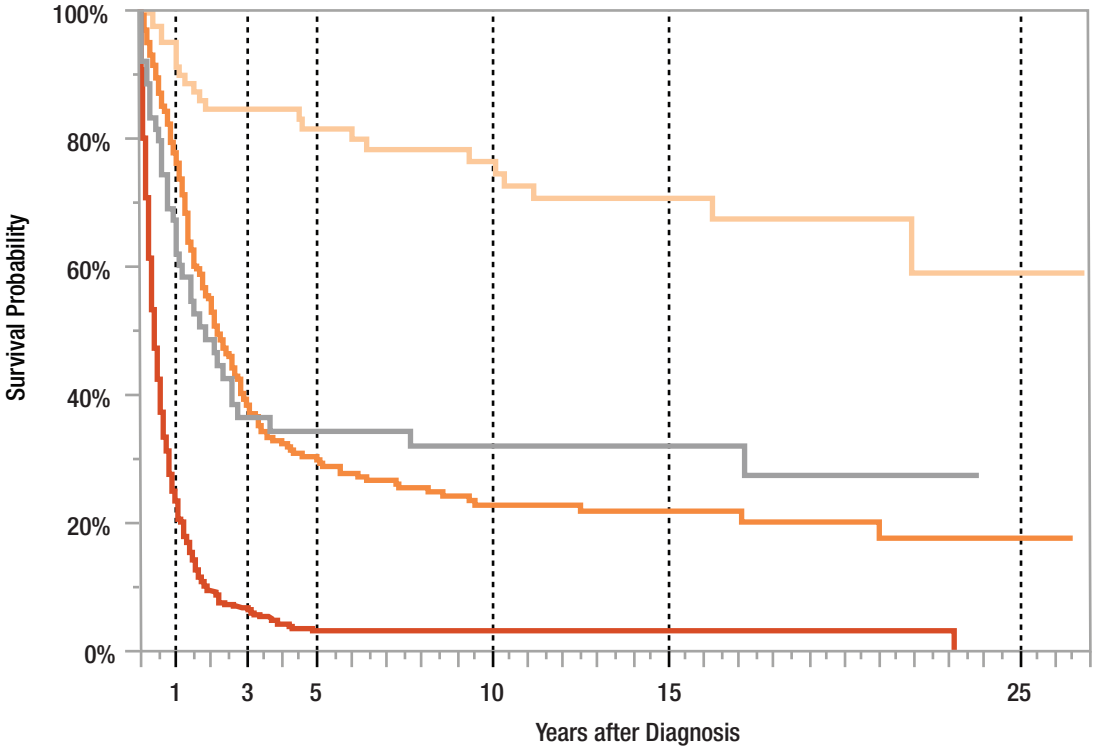


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, STOMACH CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TESTIS

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BACKGROUND

Testicular cancer is the most common cancer in adolescent and young adult (AYA) men. Most testicular cancer arise from germ cells, specialized cells that produce sperm. The two forms of testicular germ cell tumors, seminoma and non-seminoma, are both initially treated by surgery to remove the effected testicle. If there is suspicion that cancerous cells remain in the body, additional treatment is needed and can include radiation therapy, chemotherapy, and more surgery. Patients with non-seminoma germ cell tumors more often need additional treatment, as seminoma germ cell tumors tends to be less aggressive. Fortunately, with modern treatment most patients are cured of testicular cancer. Unfortunately, with time they experience additional health problems more frequently than other men. Called "late effects", these problems include, but are not limited to, metabolic syndrome, cardiovascular disease, and cancer in the remaining testicle or other parts of the body. Thus, testicular cancer survival is considered in two periods: the first few years after diagnosis when a patient can die from the disease, and later decades when late effects can influence death rates.

AYA SURVIVAL IN LOS ANGELES COUNTY

AYAs diagnosed with testicular cancer during 1988-2014 in Los Angeles County have high overall survival, over 90% at five years and 80% at 25 years after diagnosis. Survival is uniformly higher in patients with seminoma than in those with non-seminoma (Table 1). This difference becomes obvious within three years of diagnosis (Table 1, Figures 1A, 1B). This pattern is consistent with the less aggressive nature of seminoma compared to that of non-seminoma. Age at diagnosis is minimally related to survival of seminoma (Table 1, Figure 2B). However, among men with non-seminoma, those diagnosed at earlier ages have better survival than those diagnosed at 35-39 years of age, possibly reflecting a tendency for older men to be diagnosed with disease that has spread requiring more aggressive treatment and higher number of late effects (Table 1, Figure 2A). Non-Latino white men tend to have better short- and long-term survival of both forms of this cancer (Table 1, Figure 3A, 3B).

Socioeconomic status (SES) is strongly associated with survival (Table 1, Figures 4A, 4B). Men of lower SES tend to have consistently poorer survival over time, particularly with non-seminoma type, suggesting access to care as a potential obstacle. Whether the worst long term survival of low SES men with seminoma type of testicular cancer is due to greater late effects of treatment or to other causes remains to be determined. Both forms of testicular cancer have poorer survival in men with late stage* cancer (Table 1, Figures 5A, 5B). Among those with non-seminoma type, patients diagnosed early with cancer only in the testis have better survival throughout the 25 years after diagnosis than those with cancer that has spread to nearby lymph nodes (regional stage*), likely reflecting a more difficult to treat disease (Table 1, Figure 5B). Among those with seminoma type, patients with disease only in the testis have clear survival advantage seven years after diagnosis over those with disease that had spread to nearby lymph nodes, possibly reflecting more late effects of more aggressive treatment for later stage* diseases (Table 1, Figure 5A).

These data suggest two potential approaches to improving testicular cancer survival: greater access to early diagnosis and treatment, and new procedures for reducing late effects due to radiation and chemotherapy treatment while maintaining current cure rates.

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, TESTICULAR CANCER, LOS ANGELES COUNTY, 1988-2014

Testicular cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Seminoma																					
Number of Cases	2,283	—	—	277	1,338	668	102	73	945	1,092	71	453	493	515	441	364	17	1,774	349	129	31
Percent of Cases	100.0%	—	—	12.1%	58.6%	29.3%	4.5%	3.2%	41.4%	47.8%	3.1%	19.8%	21.6%	22.6%	19.3%	15.9%	0.7%	77.7%	15.3%	5.7%	1.4%
1-year survival	98.7%	—	—	96.5%	99.1%	98.8%	95.8%	100.0%	98.7%	99.1%	96.8%	99.3%	99.2%	98.8%	97.9%	98.5%	—	99.6%	98.5%	88.0%	93.5%
3-year survival	96.8%	—	—	94.3%	97.4%	96.7%	95.8%	96.9%	96.8%	97.0%	96.8%	98.3%	97.4%	95.7%	95.8%	97.2%	—	98.2%	97.5%	79.7%	86.4%
5-year survival	96.0%	—	—	94.3%	96.2%	96.2%	95.8%	96.9%	95.7%	96.1%	96.8%	97.3%	97.1%	95.3%	94.4%	95.6%	—	97.3%	96.8%	78.7%	82.4%
Non-Seminoma																					
Number of Cases	2,451	—	—	995	1,162	294	78	47	1,197	1,055	74	421	548	526	507	441	<10	1,379	514	519	39
Percent of Cases	100.0%	—	—	40.6%	47.4%	12.0%	3.2%	1.9%	48.8%	43.0%	3.0%	17.2%	22.4%	21.5%	20.7%	18.0%	—	56.3%	21.0%	21.2%	1.6%
1-year survival	95.2%	—	—	94.8%	96.1%	93.5%	94.3%	88.9%	94.3%	96.5%	97.0%	97.8%	96.9%	94.9%	92.8%	93.9%	—	99.4%	96.8%	83.8%	86.5%
3-year survival	90.6%	—	—	90.1%	91.2%	89.7%	88.0%	86.3%	88.5%	92.8%	94.8%	93.5%	93.9%	91.1%	86.9%	86.6%	—	97.1%	92.2%	73.0%	80.3%
5-year survival	89.3%	—	—	89.0%	89.9%	88.0%	88.0%	86.3%	87.1%	91.6%	94.8%	92.6%	93.2%	89.8%	85.3%	84.5%	—	96.3%	90.7%	71.0%	77.1%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, TESTICULAR CANCER, LOS ANGELES COUNTY, 1988-2014

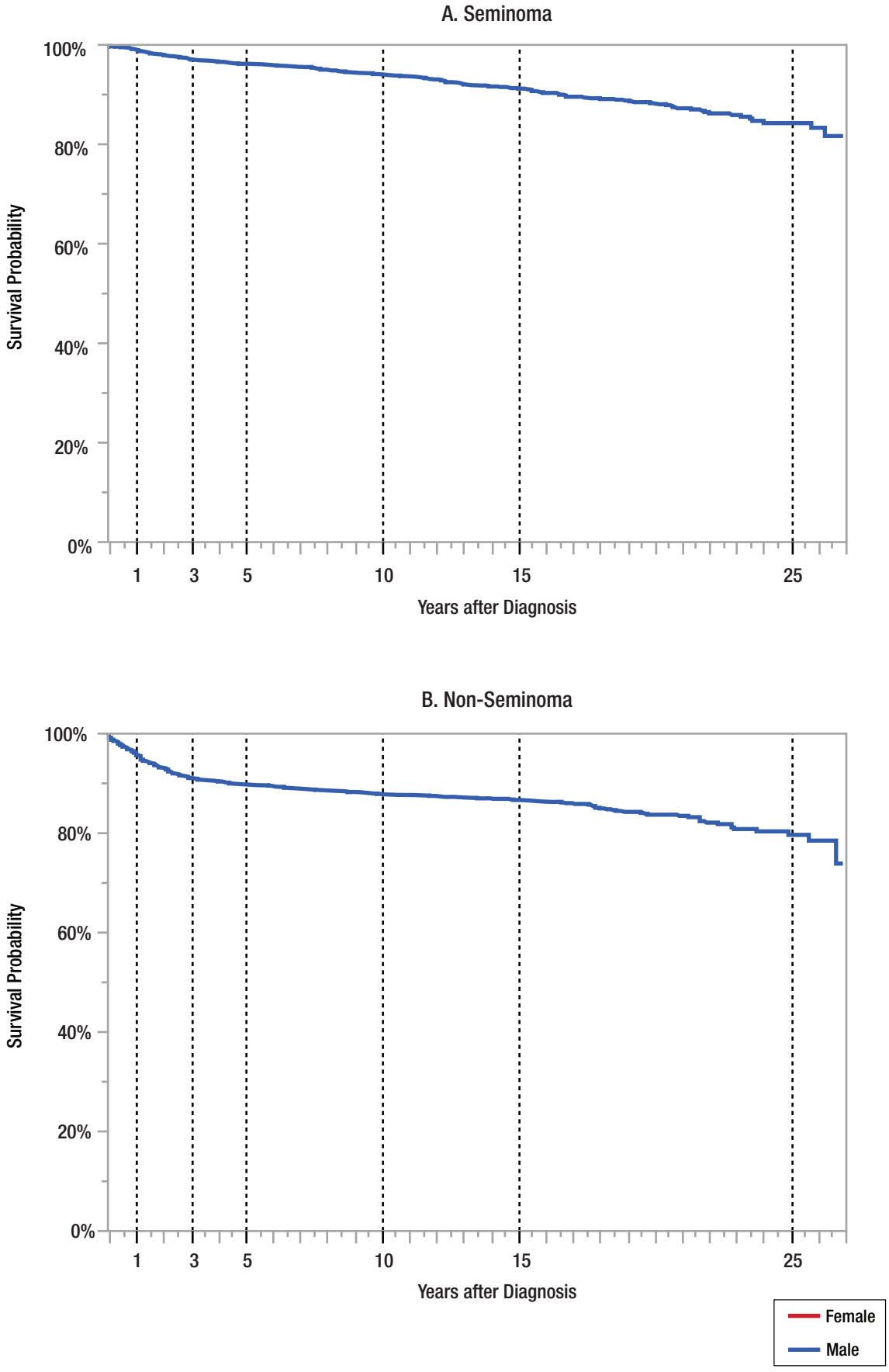


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, TESTICULAR CANCER, LOS ANGELES COUNTY, 1988-2014

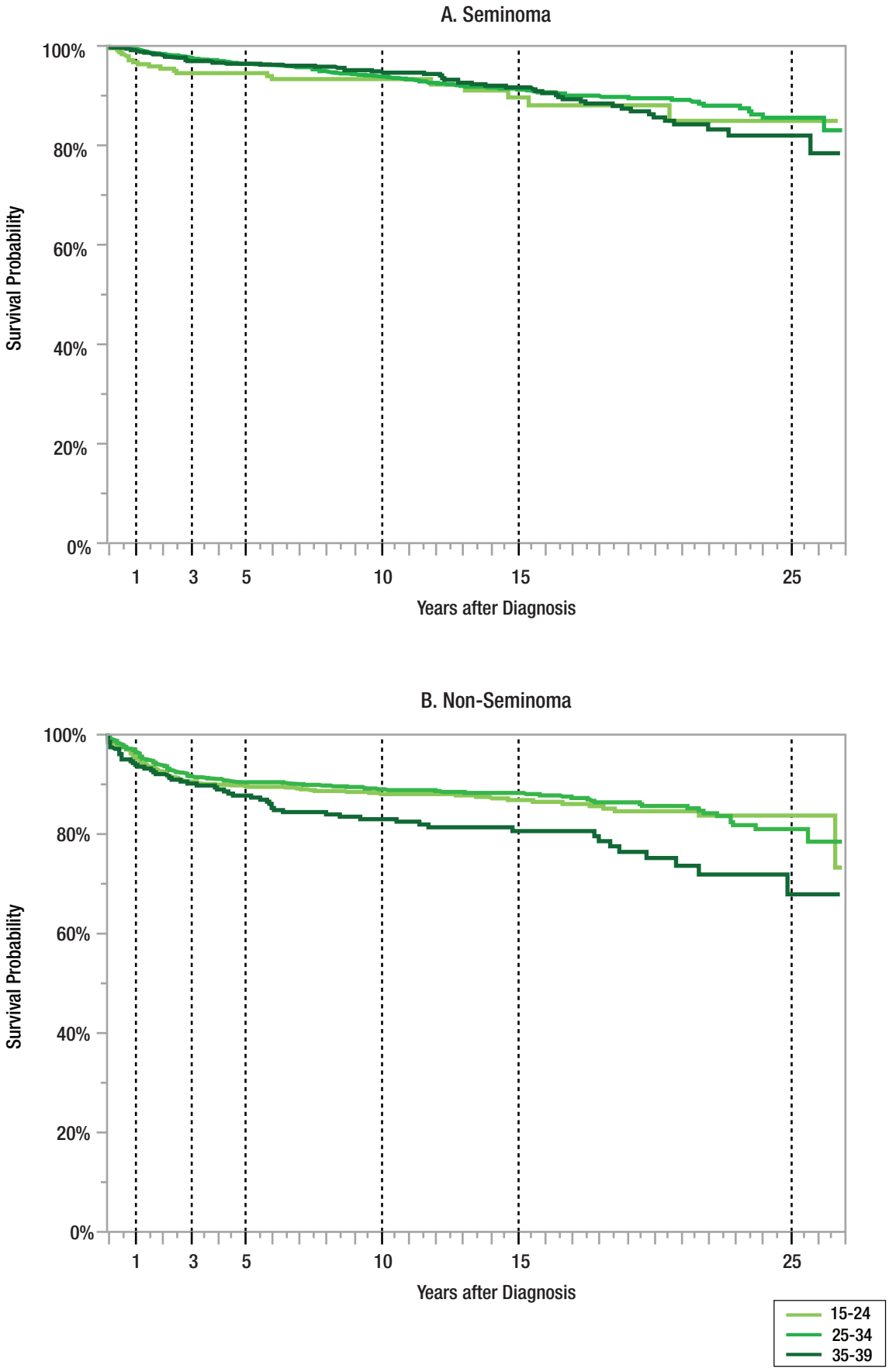


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, TESTICULAR CANCER, LOS ANGELES COUNTY, 1988-2014

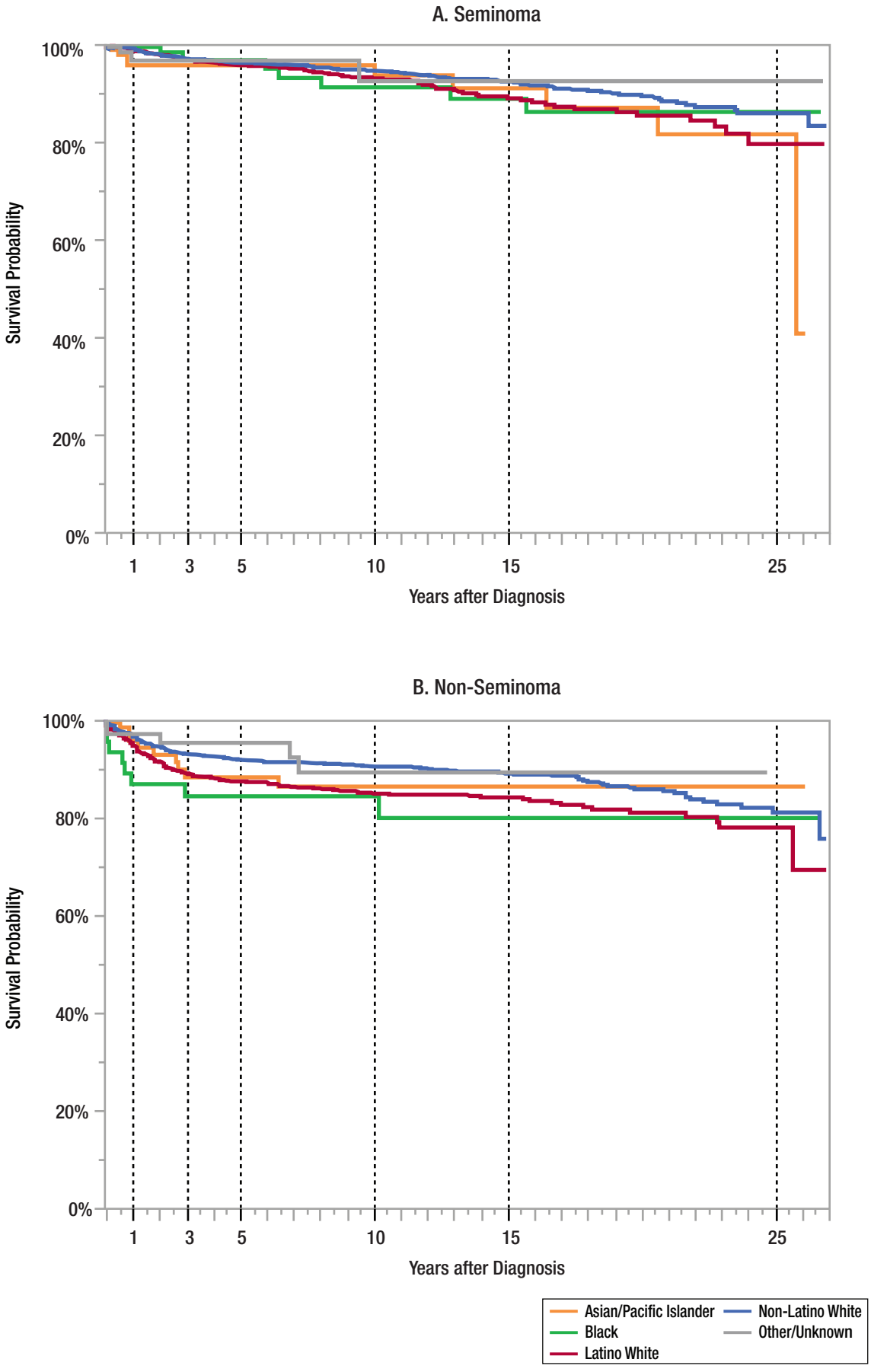


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, TESTICULAR CANCER, LOS ANGELES COUNTY, 1988-2014

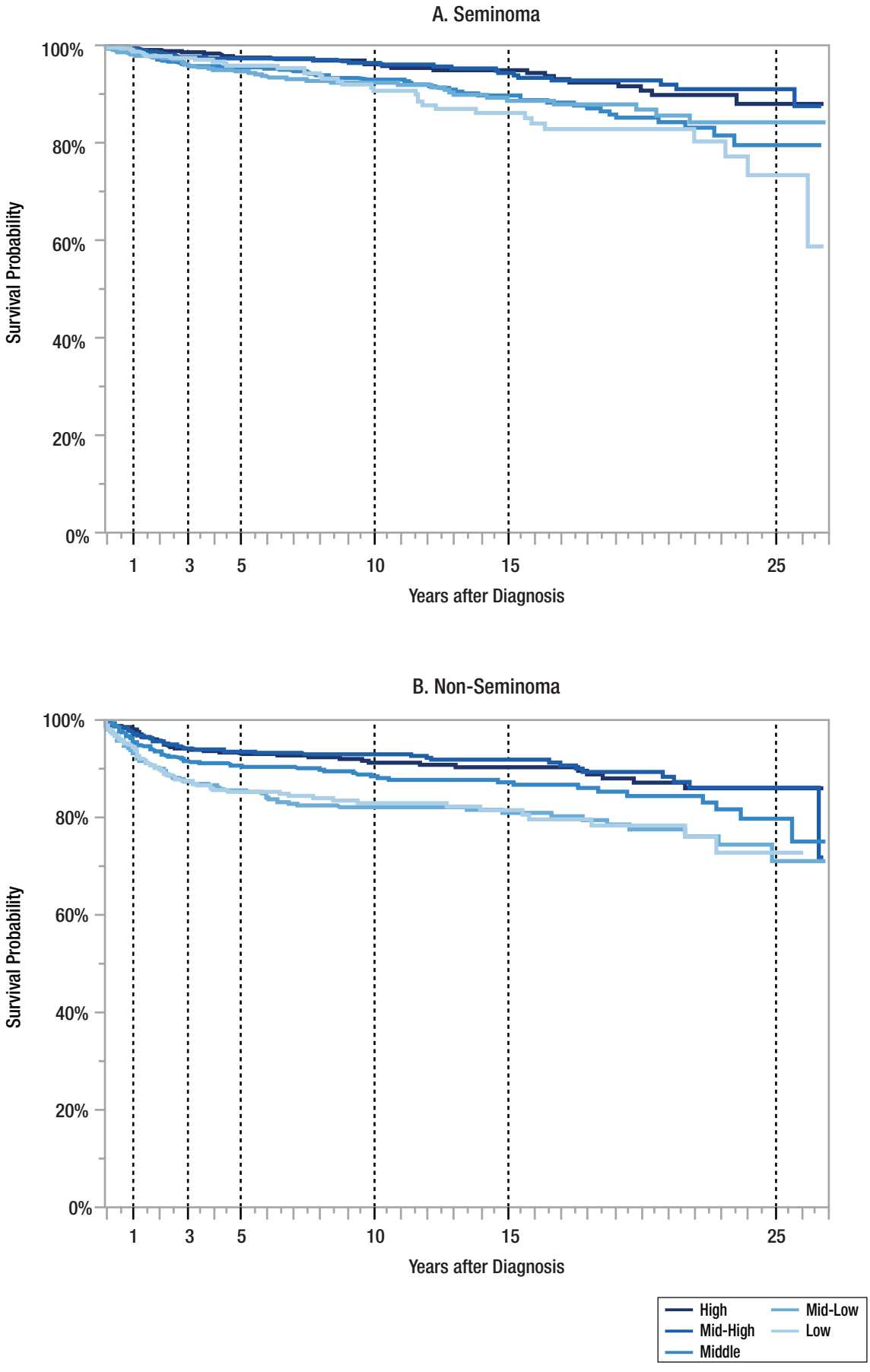
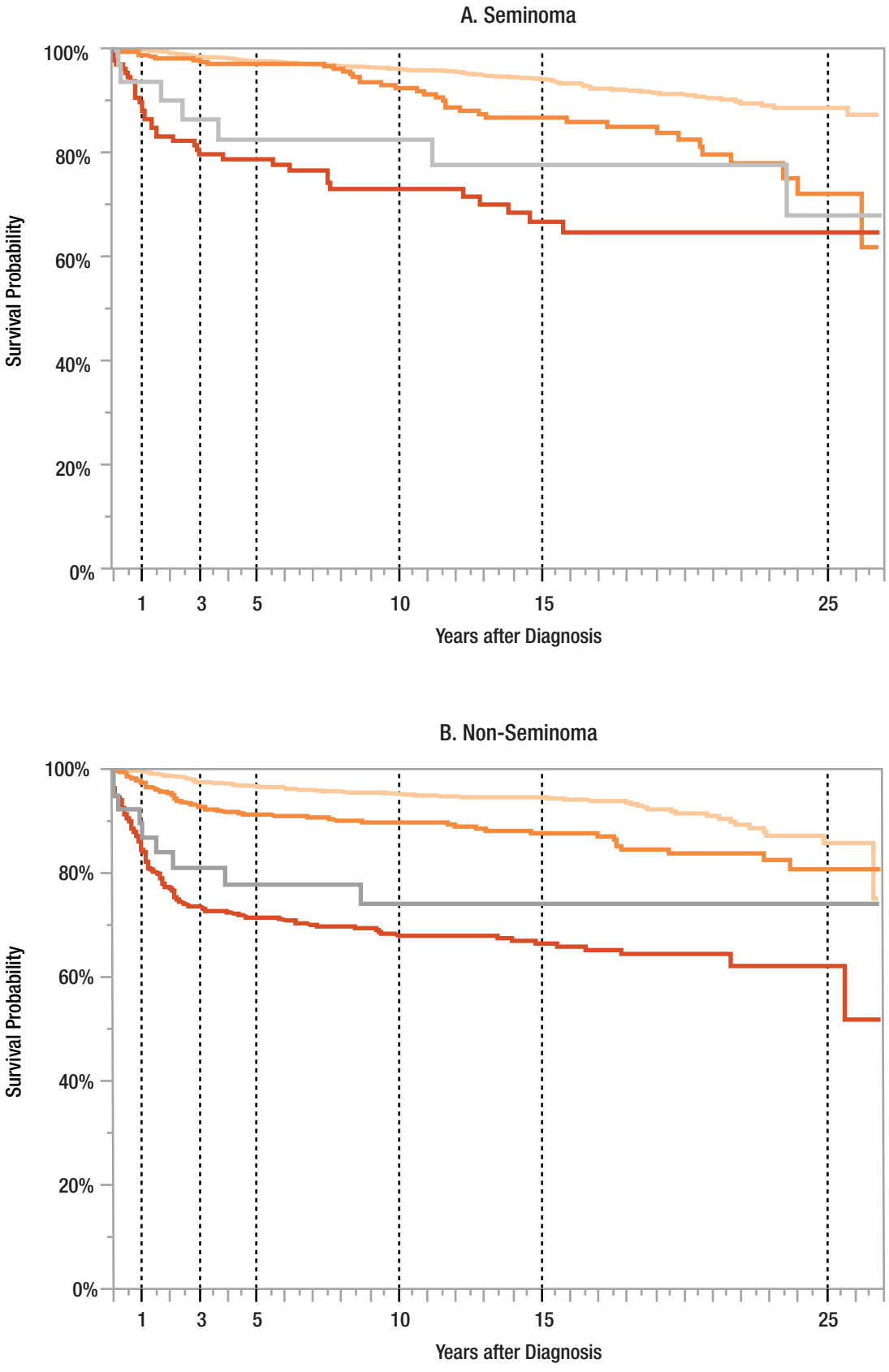


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND DISEASE STAGE*, TESTICULAR CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

THYROID

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Juliana L. Austin, MD

BACKGROUND

The thyroid is a butterfly-shaped gland located in the lower neck. It makes hormones that control metabolism, growth, development, and body temperature. Over 60,000 new cases of thyroid cancer are diagnosed in U.S. each year. The majority (about 80%) are a type called papillary thyroid cancer. In adolescents and young adults (AYAs) aged 15-39 years old, thyroid cancer is about five times more common in women than in men, making it the second most commonly diagnosed cancer in AYA women. It accounts for about 17% of all new cancer diagnoses among AYA women in the U.S.

The cause of thyroid cancer is largely unknown. Being exposed to radiation to the head and neck appears to be a major risk factor for thyroid cancer. Some people are at higher risk for thyroid cancer because of inherited genetic conditions, diets low in iodine (uncommon in the U.S. and other countries where iodine is added to table salt and other foods), or past history of certain thyroid conditions. In the past few decades, thyroid cancer incidence has been increasing worldwide. Part of the increase is because of technological improvements in diagnosing thyroid tumors. It has also been suggested, but not clearly proven, that the increase may also be due to the use of radiation treatment for certain childhood medical conditions.

Standard treatment for thyroid cancer includes surgery, radioactive iodine, hormone therapy, radiation, chemotherapy and targeted drug therapy. The type of treatment depends on the type of thyroid cancer (papillary, follicular, medullary, or anaplastic), how far the cancer has spread (stage*), and the overall health of the patient. Since thyroid cancer is common in women of child-bearing age, there is often a delay in surgery or radioactive iodine therapy for pregnant women.

Thyroid cancer survival varies by cancer type, stage*, and age at diagnosis, but is generally quite high. Most patients with thyroid cancer have nearly a 100% 5-year survival rate. However, survival for late stage* in adults is about 50% for papillary and follicular types and less than 30% for medullary type. Thyroid cancer in children often presents as late stage*, but has a much higher survival rate. For AYAs in the U.S., the average 5-year relative survival rate of these cancers is also nearly 100%.

AYA SURVIVAL IN LOS ANGELES COUNTY

A total of 6,290 cases of thyroid cancers were diagnosed among Los Angeles County AYA residents during 1988-2014, with the majority (59%) diagnosed at early stage* (Table 1). There are more cases among women (82%) than men (18%) and among whites (40% non-Latino white and 39% Latino white) than non-whites (13% Asian/Pacific Islander and 4% black) (Table 1). About half were diagnosed in 25-34 year olds (Table 1). The frequency of cases decreases with increasing poverty, with 23% diagnosed among the persons of high socioeconomic status (SES) and 14% among persons of low SES (Table 1).

Overall, survival is high for thyroid cancer regardless of sex, age, race/ethnicity, or SES (Table 1, Figures 1-4). Men and women have similar 5-year survival, but women have slightly better survival after 5 years (Table 1, Figure 1). For age, survival drops slightly 15 year after diagnosis for patients over age 25 at diagnosis compared to patients younger than 25 years old at diagnosis (Table 1, Figure 2). There are no substantial differences in survival by race/ethnicity or SES (Table 1, Figures 3-4).

The most important difference in survival is by stage* of disease at diagnosis. Late stage* disease consistently has lower survival (93% 5-year survival for late stage* compared to 99% for early stage*), and the difference increases with time (Table 1, Figure 5).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, THYROID CANCER, LOS ANGELES COUNTY, 1988-2014

Thyroid Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	1,113	5,177	—	1,056	3,155	2,079	837	256	2,473	2,490	234	1,451	1,363	1,366	1,181	897	32	3,680	2,268	202	140
Percent of Cases	17.7%	82.3%	—	16.8%	50.2%	33.1%	13.3%	4.1%	39.3%	39.6%	3.7%	23.1%	21.7%	21.7%	18.8%	14.3%	0.5%	58.5%	36.1%	3.2%	2.2%
1-year survival	99.3%	99.7%	—	99.5%	99.5%	99.7%	99.7%	98.8%	99.4%	99.8%	100.0%	99.7%	99.8%	99.5%	99.9%	98.9%	—	99.7%	99.8%	97.0%	97.0%
3-year survival	98.2%	99.2%	—	99.2%	98.9%	99.3%	99.1%	98.8%	98.5%	99.6%	99.5%	99.6%	99.3%	98.6%	98.9%	98.8%	—	99.5%	99.2%	94.2%	93.7%
5-year survival	97.7%	99.0%	—	99.2%	98.5%	98.8%	98.7%	97.8%	98.1%	99.4%	99.5%	99.3%	99.1%	98.4%	98.3%	98.3%	—	99.3%	98.7%	92.9%	93.7%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, THYROID CANCER, LOS ANGELES COUNTY, 1988-2014

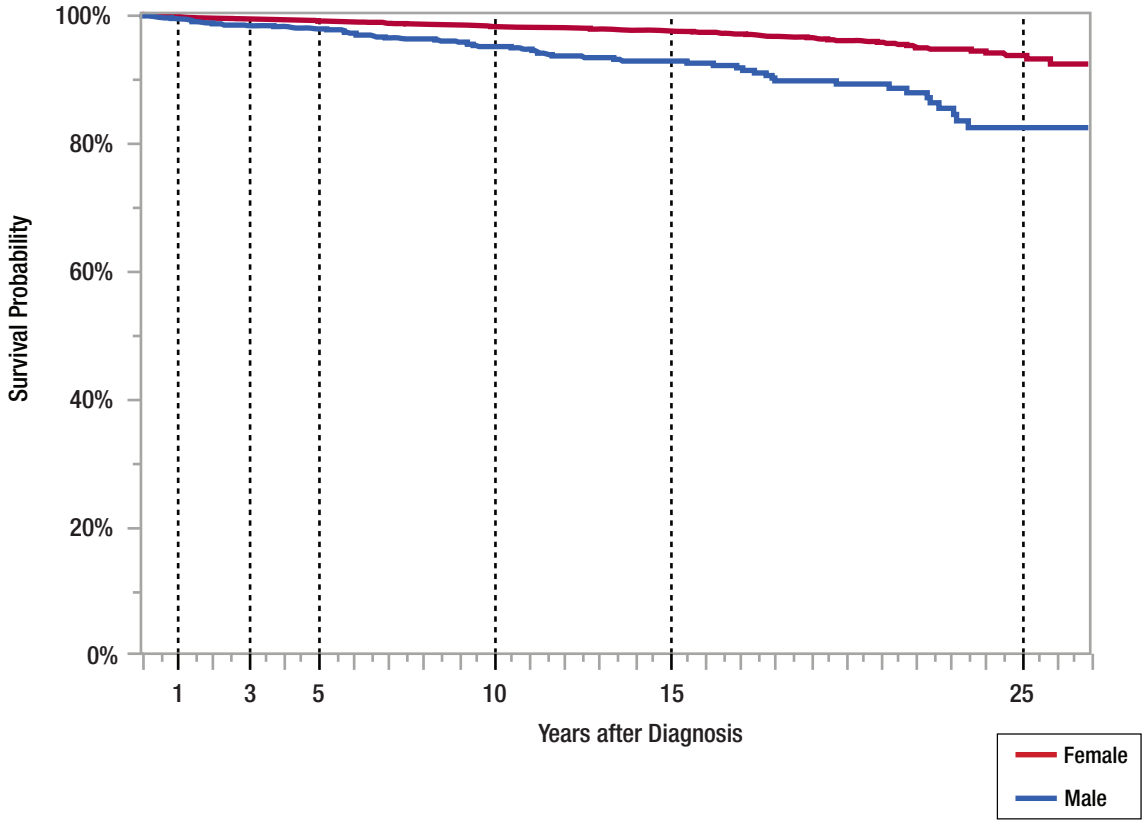


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, THYROID CANCER, LOS ANGELES COUNTY, 1988-2014

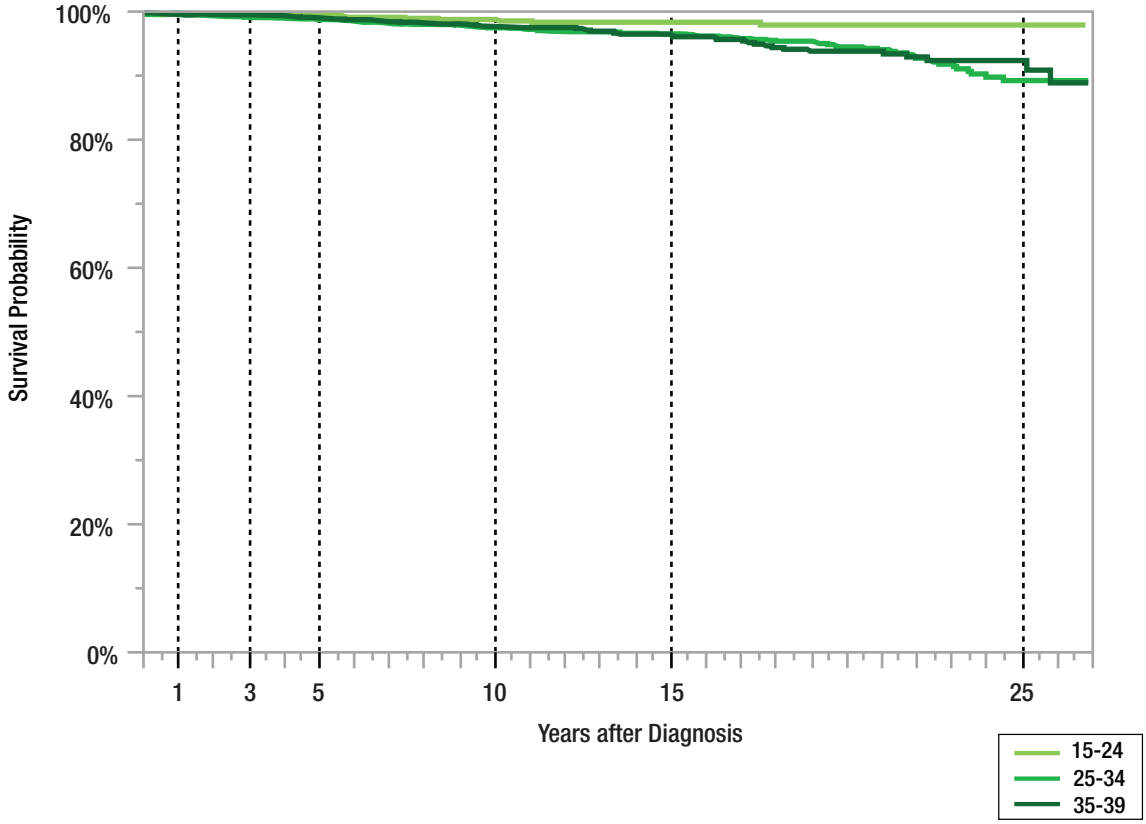


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, THYROID CANCER, LOS ANGELES COUNTY, 1988-2014

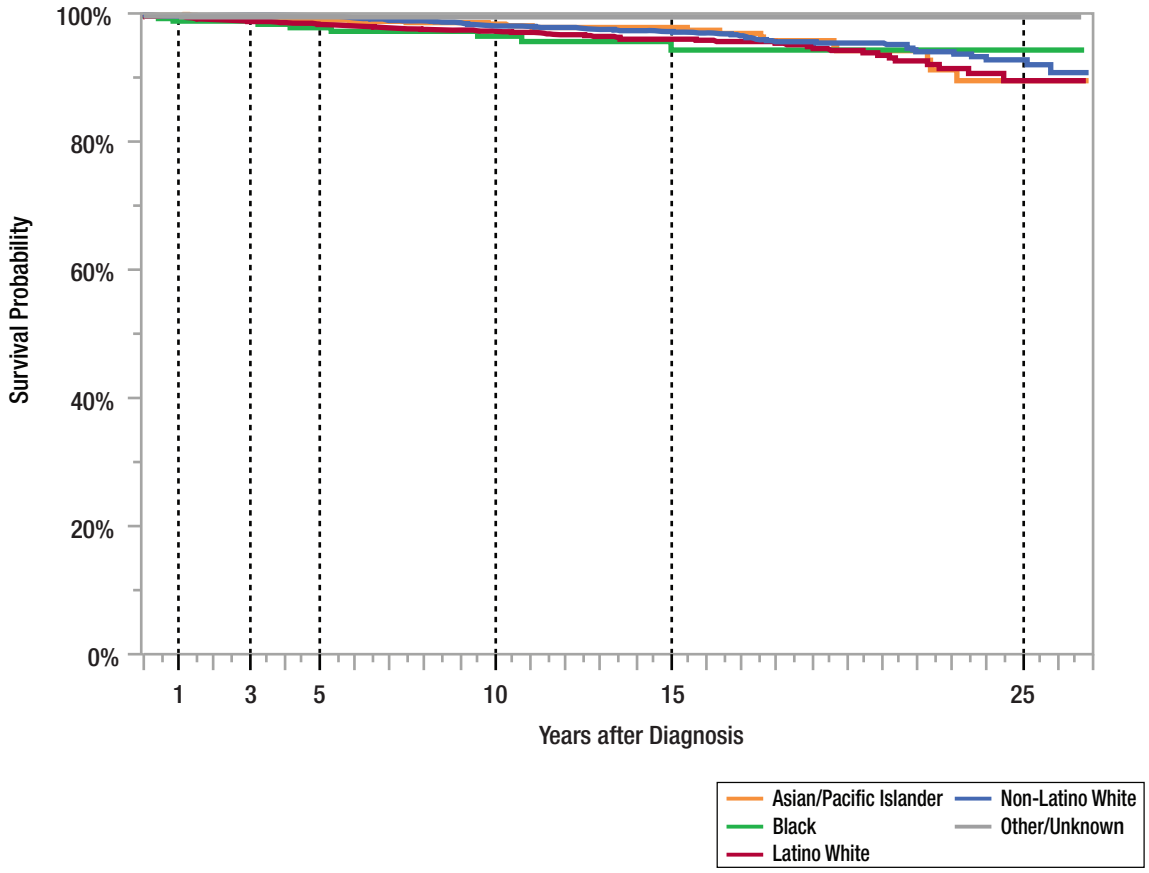


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, THYROID CANCER, LOS ANGELES COUNTY, 1988-2014

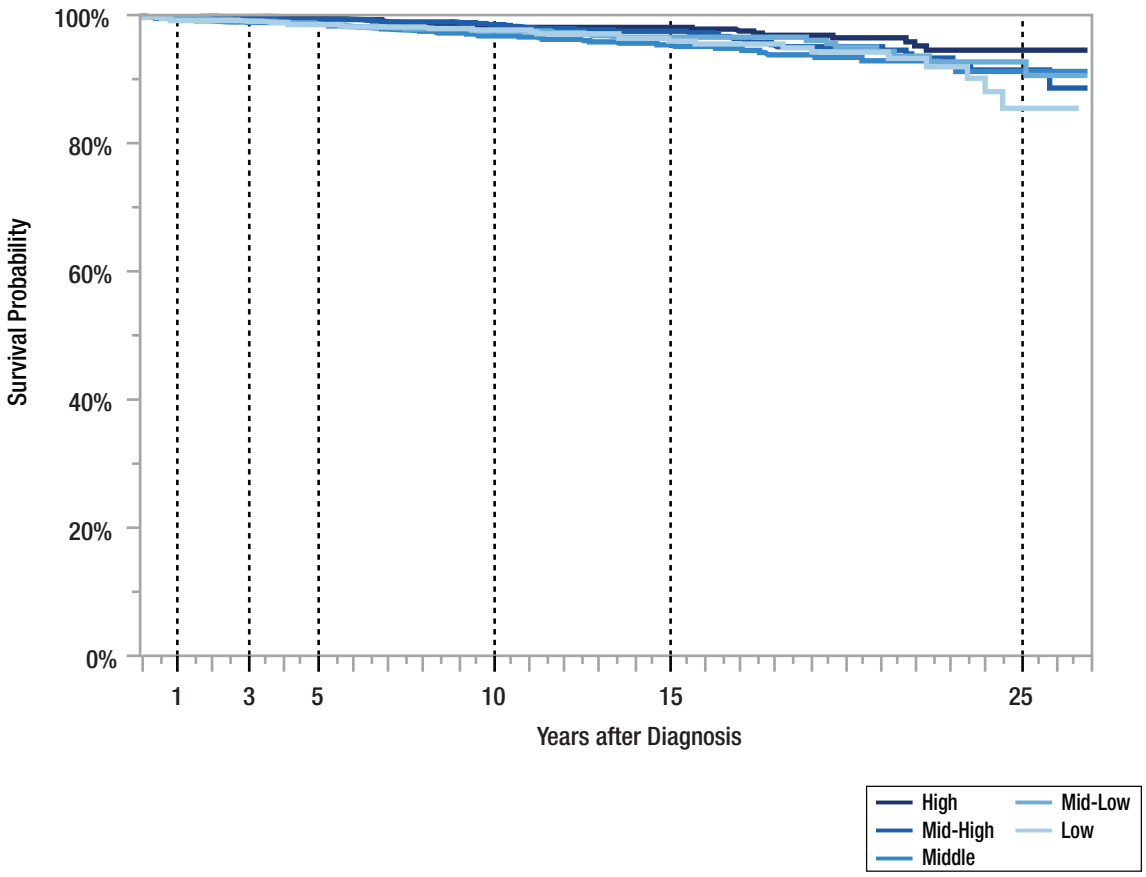
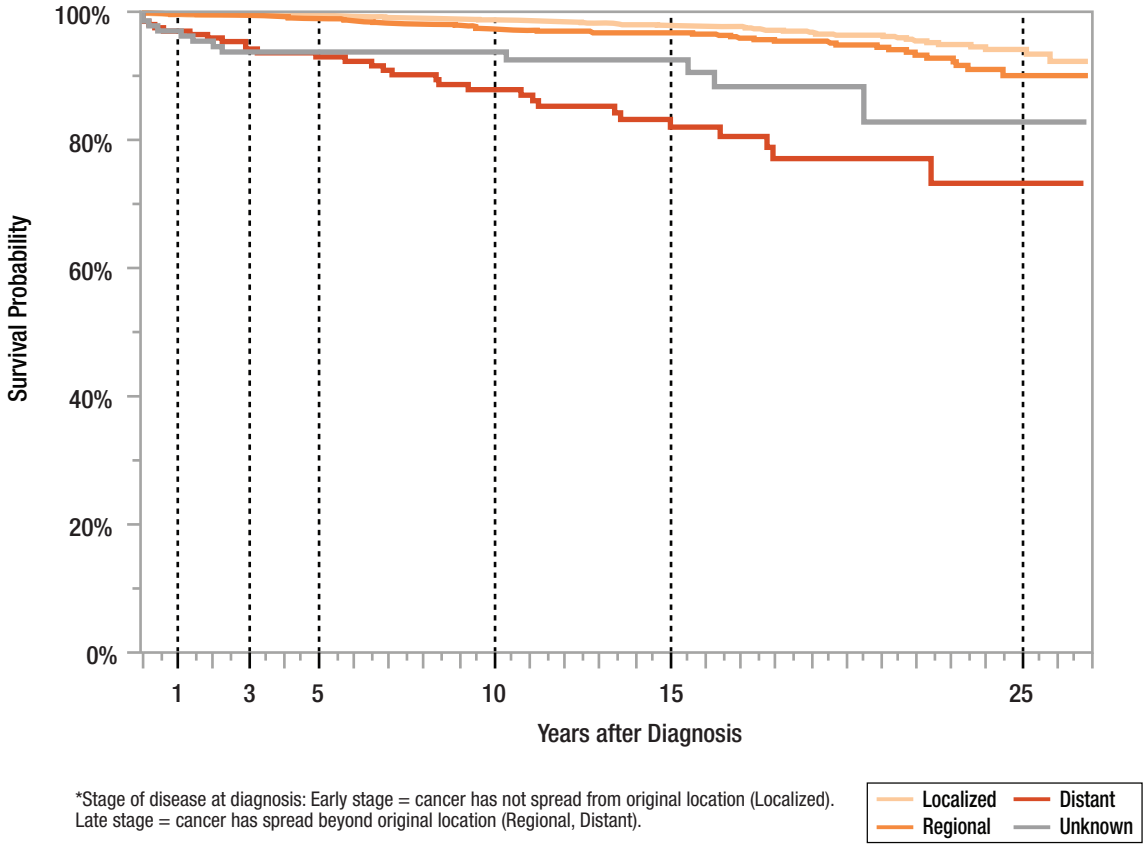


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, THYROID CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

UTERUS

V. Wendy Setiawan, PhD
Koji Matsuo, MD

BACKGROUND

Nearly all cancers of the uterus (womb) come from cells that line the internal surface of the uterus (endometrium). Therefore, uterine cancer is also called endometrial cancer. It is the most common gynecologic cancer, but it is rarely diagnosed in women under age 45 years old. Approximately 75% of endometrial cancer patients are diagnosed after the age of 55 years old. Because the majority of endometrial cancers are found at an early stage*, the prognosis for this cancer is generally good. The 5-year survival rates for endometrial cancer across all stages are 70% to 80%, ranging from 90% for patients with early stage* disease to 20% for late stage* diagnoses. The standard treatment for women with endometrial cancer is surgery. This may include removing both the cervix and uterus, removing both fallopian tubes and ovaries, and possibly removing lymphoid tissue in the pelvis and abdomen for those patients with increased risk of spread to the lymph nodes. Postoperative radiation can be useful to reduce the risk of the cancer coming back for less aggressive, early stage* endometrial cancer of certain tumor factors. Both chemotherapy and radiation are often used for aggressive and/or late stage* disease. In addition, hormonal therapy can be effective for women with endometrial cancer who still want to have children.

Factors that cause imbalance of female sexual hormones (estrogen and progesterone) in the body influence the risk of endometrial cancer. Endometrial cancer is caused by estrogen stimulation without the balancing effects of progesterone. Taking hormonal therapies that contain estrogen but not progesterone to treat menopausal symptoms increases the risk of endometrial cancer. Obesity is an important risk factor for endometrial cancer because, after menopause, fat cells are major sources of estrogen and inflammation. Pregnancy and increasing number of births protect against endometrial cancer because they reduce the number of menstrual cycles in a woman's lifetime and thus, her total exposure to estrogens. Early age at menarche and late age at menopause have been associated with an increased risk of endometrial cancer. Birth control pills containing estrogen and progesterone protect against endometrial cancer.

AYA SURVIVAL IN LOS ANGELES COUNTY

A total of 1,168 endometrial cancer cases were diagnosed among adolescent and young adult (AYA) women aged 15-39 years old in Los Angeles County during 1988-2014 (Table 1). A little over half of the patients are Latina whites (54%) and very few are blacks (5%). The number of cases increase with age, with the oldest AYA group (ages 35-39) accounting for 54%. More patients are of lower socioeconomic status (SES). The majority (75%) of the cancers are diagnosed at early stage* (Table 1).

The overall 5-year survival rate of endometrial cancer among AYA women is 93% (Table 1, Figure 1). Similar to national figures, the survival rate of endometrial cancer in Los Angeles County is strongly determined by cancer stage*. The 5-year survival rate is high for patients with early stage* disease (97%) and much lower for patients with late stage* disease (32%) (Table 1, Figure 5). Significant racial differences in endometrial cancer survival are observed, with black women having the lowest 5-year survival rate (87%) (Table 1, Figure 3). The survival rates are similar in non-Latina whites and Asian/Pacific Islanders (91%) and highest in Latina whites (95%) (Table 1, Figure 3). Age and SES do not influence endometrial cancer survival among AYA women in Los Angeles County (Table 1, Figures 2, 4).

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

TABLE 1. DISTRIBUTION OF AYA CANCER CASES AND SURVIVAL PROBABILITIES BY PATIENT AND TUMOR CHARACTERISTICS, UTERINE CANCER, LOS ANGELES COUNTY, 1988-2014

Uterine Cancer	Sex			Age Group			Race/Ethnicity					Socioeconomic Status						Stage*			
	Male	Female	Other	15-24	25-34	35-39	Asian/Pacific Islander	Black	Latino White	Non-Latino White	Other/Unknown	High	Mid-High	Middle	Mid-Low	Low	Missing	Localized	Regional	Distant	Unknown
Number of Cases	—	1,168	—	28	508	632	168	59	634	253	54	119	176	256	323	287	<10	877	154	49	88
Percent of Cases	—	100.0%	—	2.4%	43.5%	54.1%	14.4%	5.1%	54.3%	21.7%	4.6%	10.2%	15.1%	21.9%	27.7%	24.6%	—	75.1%	13.2%	4.2%	7.5%
1-year survival	—	97.0%	—	100.0%	97.1%	96.9%	95.1%	96.6%	97.7%	96.3%	100.0%	94.9%	96.4%	97.5%	96.0%	98.9%	—	99.4%	97.9%	47.0%	98.7%
3-year survival	—	94.7%	—	96.0%	94.9%	94.4%	93.0%	89.2%	96.3%	92.5%	100.0%	91.2%	93.9%	95.3%	94.2%	96.7%	—	98.2%	93.5%	35.1%	94.4%
5-year survival	—	93.1%	—	96.0%	93.2%	92.9%	91.5%	87.1%	94.5%	91.2%	100.0%	90.1%	93.1%	93.7%	91.1%	96.2%	—	97.4%	90.0%	31.6%	88.9%

* Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

FIGURE 1. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SEX, UTERINE CANCER, LOS ANGELES COUNTY, 1988-2014

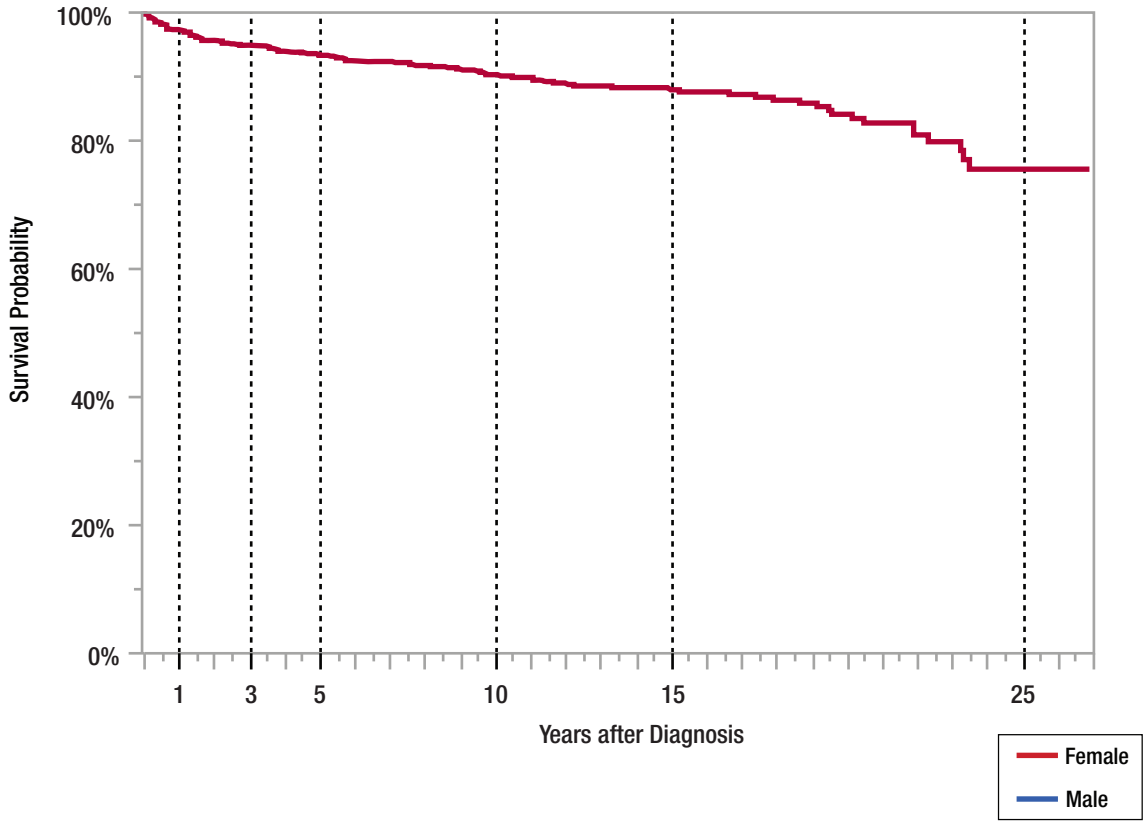


FIGURE 2. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND AGE GROUP, UTERINE CANCER, LOS ANGELES COUNTY, 1988-2014

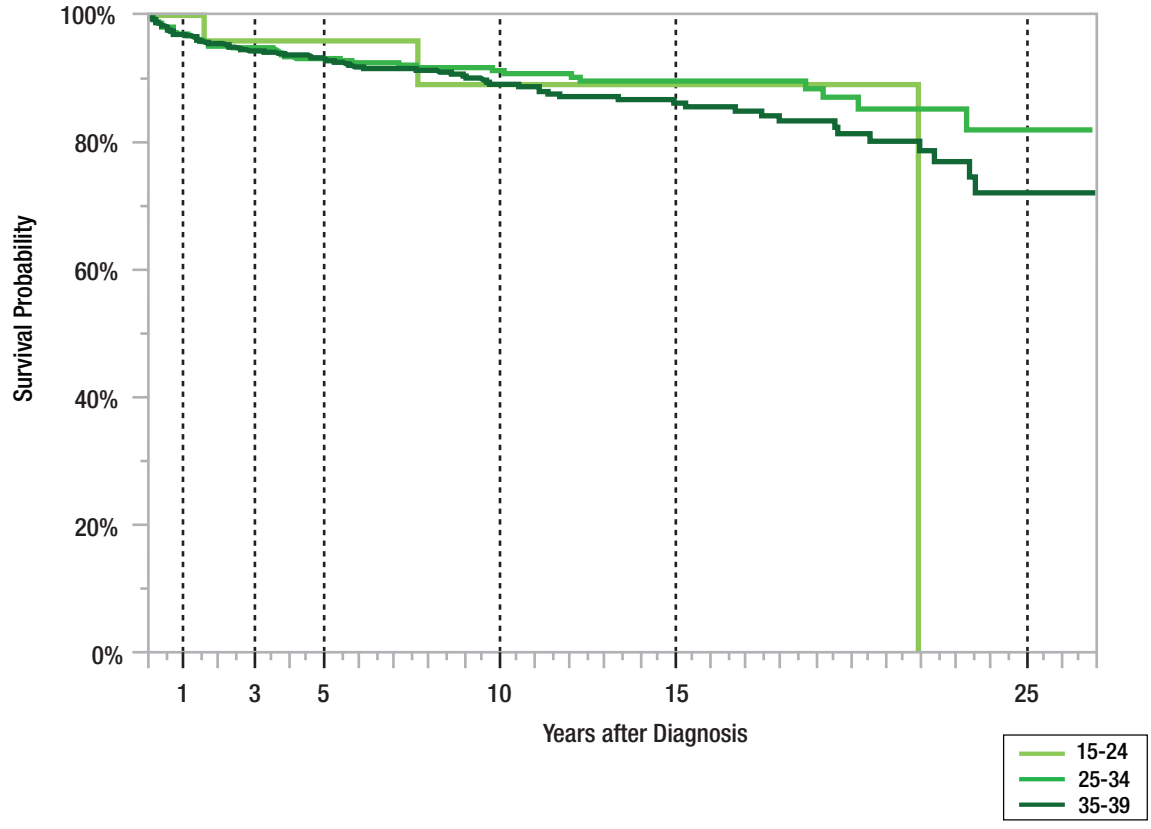


FIGURE 3. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND RACE/ETHNICITY, UTERINE CANCER, LOS ANGELES COUNTY, 1988-2014

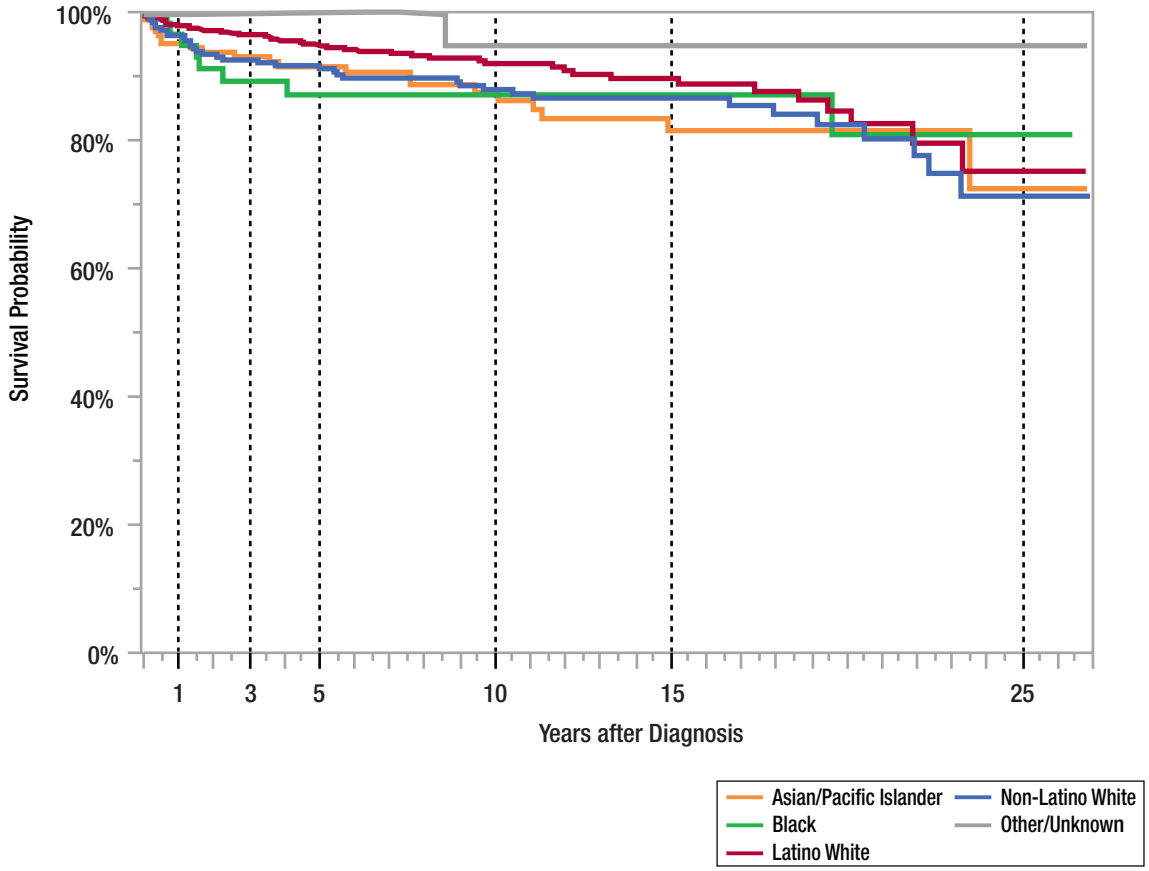


FIGURE 4. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND SOCIOECONOMIC STATUS, UTERINE CANCER, LOS ANGELES COUNTY, 1988-2014

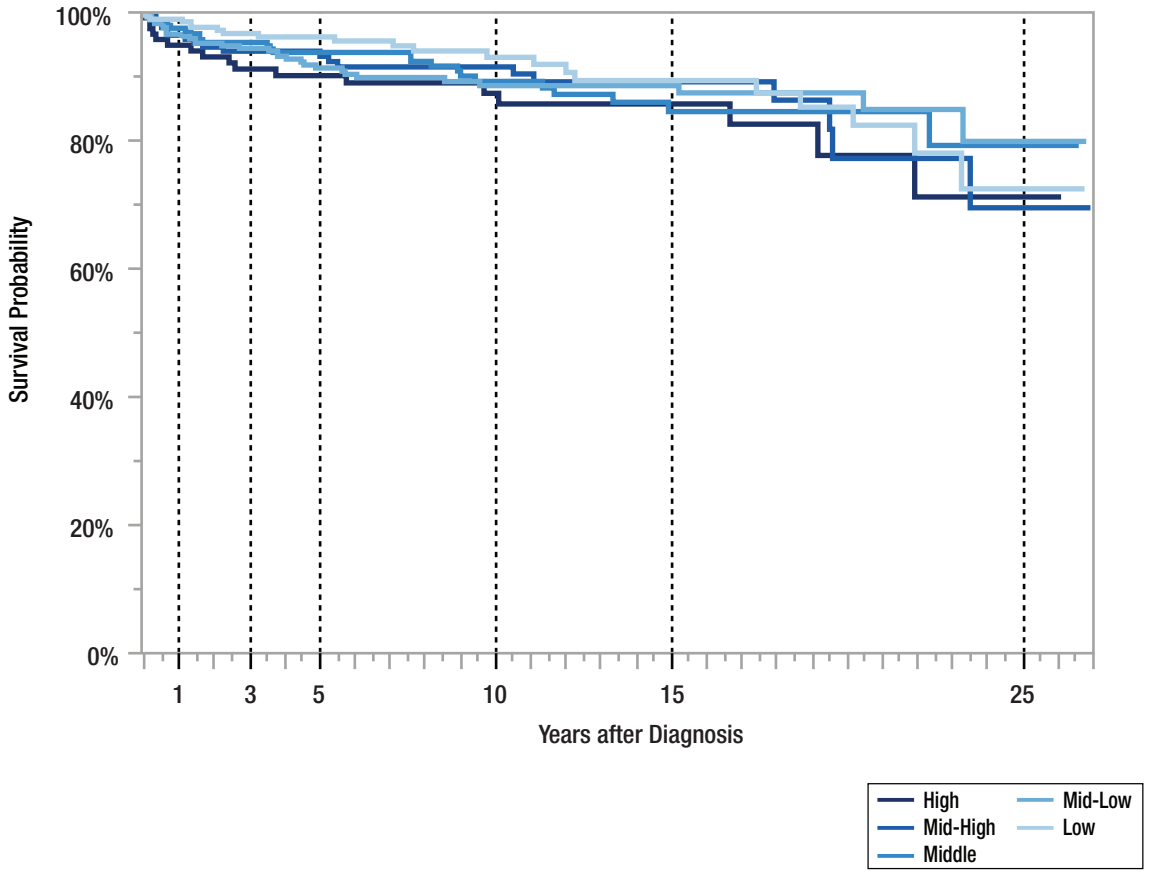
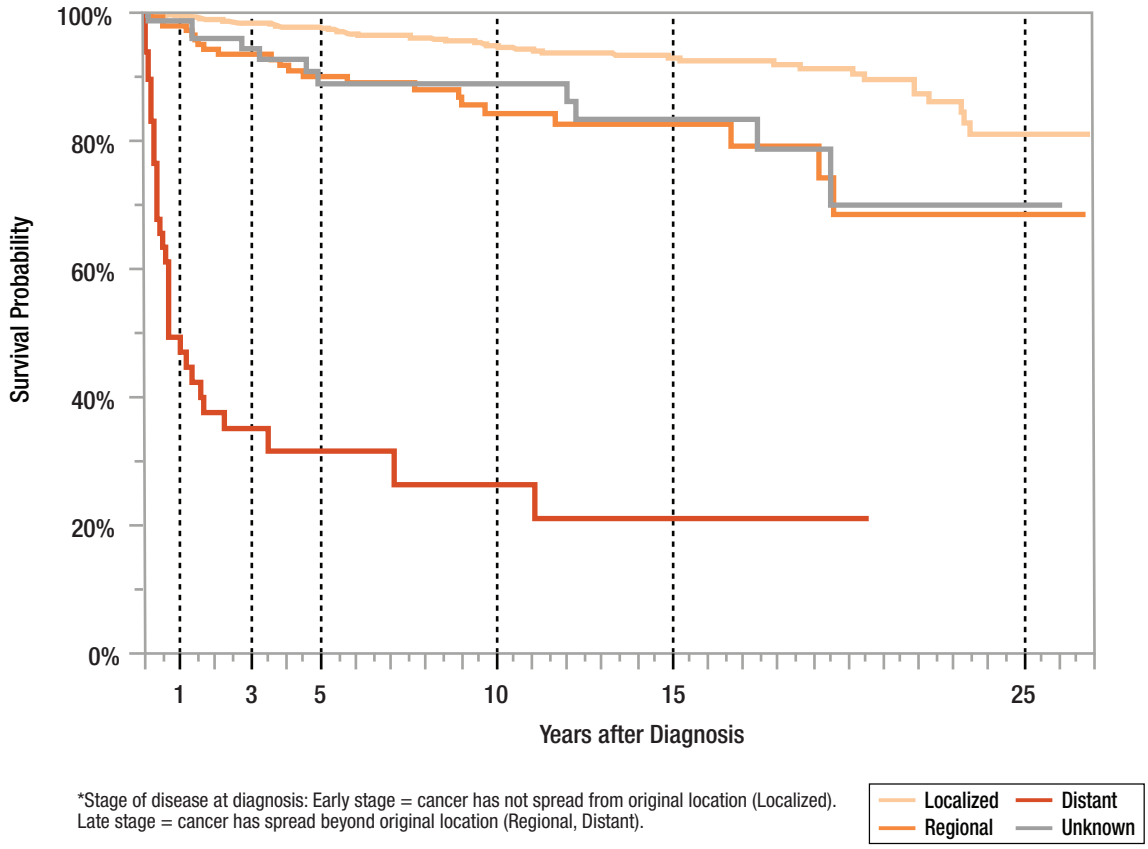


FIGURE 5. OBSERVED SURVIVAL PROBABILITY AMONG AYAS BY YEARS AFTER DIAGNOSIS AND STAGE*, UTERINE CANCER, LOS ANGELES COUNTY, 1988-2014



*Stage of disease at diagnosis: Early stage = cancer has not spread from original location (Localized). Late stage = cancer has spread beyond original location (Regional, Distant).

APPENDIX A: DETAILED METHODS

DETERMINATION OF RACE/ETHNICITY OF CANCER PATIENTS

Race/ethnicity and Spanish/Latino origin of cancer patients are reported to the CSP by hospitals and physician offices according to information in medical records. Based on the reported information, and using the North American Association of Central Cancer Registries Hispanic/Latino Identification Algorithm (NHIA) to further identify cases of Spanish/Latino origin, the CSP codes race/ethnicity into mutually exclusive groups for research and surveillance purposes. In this monograph, cancer patients were classified into the mutually exclusive racial/ethnic groups of: non-Latino white, Latino white, black, Asian/Pacific Islander (including Chinese, Japanese, Filipino, Korean, Vietnamese, Asian Indian, Pakistani, Sri Lankan, Bangladeshi, Thai, Hmong, Cambodian, Laotian, Hawaiian, Samoan), and Other. Patients with unknown race/ethnicity (1.4% of total cases) are excluded from race/ethnicity-specific analysis, but included in the Other group and in all races combined.

ESTIMATING SOCIOECONOMIC STATUS

Because hospitals and physicians do not collect individual patients' socioeconomic status (SES) information, the CSP estimates cancer patients' SES using information from the Census about their neighborhood of residence at the time they were diagnosed. For the period of 1988-2014, the CSP SES measurement was based on 1990 census results for Los Angeles County at census tract level for cancer cases diagnosed during 1988-1995, 2000 census data at the census block group level for cases of 1996-2005, and American Community Survey (ACS) 2006-2010 5-year estimates at census block group level for cases diagnosed during 2006-2014. From each census or ACS database, median household income and average educational attainment for residents aged 25 years and older were used respectively to rank all the census tracts or census block groups. The combined ranking scores at each census geographic level were ranked again by quintiles representing five SES groups from high (SES=1) to low (SES=5).

POPULATION DENOMINATORS

To calculate cancer incidence rates provided in the introductory section, annual population estimates are needed. The population estimates for Los Angeles County during 1988-2014 by age, sex, and race/ethnicity were based on linear interpolation of census results between censuses for intercensal years (i.e., 1990-2000, 2000-2010) and linear extrapolation of adjacent decade's population trends for obtaining 1988-1989 and 2011-2014 annual population estimates.

CALCULATING INCIDENCE RATES

Age-adjusted rate: The age-adjusted rate is a weighted average of the age-specific rates, where the weights represent the age distribution of a standard population. Rates in this report are age adjusted by the direct method to the 2000 U.S. population, and are calculated per 100,000 persons. Age-adjustment allows meaningful comparisons of cancer rates by controlling for differences in the age distribution of two populations, which can profoundly affect cancer rates. The age-adjusted rate is calculated as:

$$A.A.R. = \sum_{i=0-4}^{85+} (w_i r_i)$$

where A.A.R. represents the age-adjusted rate, w_i is the proportion of age group i in the standard population, and r_i is the Los Angeles County age-specific rate for the age group.

Age-specific rate: The age-specific rate is calculated by dividing the total number of cases in a specific age group by the total population in that age group. This rate is then multiplied by 100,000 to yield an age-specific rate per 100,000 population. The age-specific rate is calculated as:

$$r_i = \left(\frac{c_i}{n_i}\right)$$

where r_i is the age-specific rate for age group i, c_i is the count of cases for that age group, and n_i is the count of persons at risk (i.e., the population) for that age group.

CALCULATING SURVIVAL PROBABILITIES

The probability of surviving to a certain time after diagnosis (written as *S(t)*, where t is time) can be derived from the probability density function *f(t)* and cumulative distribution function *F(t)* of survival times. The probability density function *f(t)* describes likelihood of still being alive at time *t*. The probability of surviving to some time point less than or equal to time *t*, or *P(Time ≤ t)*, can be described by the cumulative distribution function $F(t) = \int_0^t f(t)dt$. A simple transformation of the cumulative distribution function *F(t)* produces the survival function

$$S(t) = 1 - F(t) = \int_t^\infty f(t)dt.$$

THE KAPLAN-MEIER ESTIMATOR OF THE SURVIVAL FUNCTION

The Kaplan-Meier survival function estimator is calculated as:

$$\hat{S}(t) = \prod_{t_i \leq t} \frac{n_i - d_i}{n_i}$$

Where n_i is the number of subjects at risk at time t_i and d_i is the number of subjects who fail (die) at time t_i. Each term in the product $(\frac{n_i - d_i}{n_i})$ is the conditional probability of survival beyond time t_i, given the subject has survived up to time t_i. The survival function estimate of the unconditional probability of survival beyond time *t* is then obtained by multiplying together these conditional probabilities up to time *t* together. The unconditional probability of survival beyond time *t* is the probability of survival beyond time *t* from the onset of risk.

APPENDIX B: SEER AYA SITE RECODE

SITE GROUP	ICD-O-3 BEHAVIOR RECODE	PRIMARY SITE	ICD-O-3 HISTOLOGY	RECODE
1 Leukemias				
1.1 Acute lymphoid leukemia	3	C000-C809	9826, 9835-9836	01
	3	C420-C421, C424	9811-9818, 9837	01
1.2 Acute myeloid leukemia	3	C000-C809	9840, 9861, 9865-9867, 9869, 9871-9874, 9891, 9895-9898, 9910-9911, 9920	02
1.3 Chronic myeloid leukemia	3	C000-C809	9863, 9875-9876, 9945-9946	03
1.4 Other and unspecified leukemia	3	C000-C809	9742, 9800-9801, 9805-9809, 9820, 9831-9834, 9860, 9870, 9930-9931, 9940, 9948, 9963-9964	04
	3	C420-C421,C424	9823, 9827	04
2 Lymphomas				
2.1 Non-Hodgkin lymphoma	3	C000-C809	9590-9591, 9596-9597, 9670-9671, 9673, 9675, 9678-9680, 9684, 9687-9691, 9695, 9698-9702, 9705, 9708-9709, 9712, 9714, 9716-9719, 9725-9729, 9735, 9737-9738	05
	3	C000-C419,C422-C423,C425-C809	9811-9818, 9823, 9827, 9837	05
2.2 Hodgkin lymphoma	3	C000-C809	9650-9655, 9659, 9661-9665, 9667	06
3 CNS and Other Intracranial and Intraspinal Neoplasms (all behaviors)				
3.1. Astrocytoma				
3.1.1 Specified low-grade astrocytic tumors	0, 1, 3	C723	9380	07
	0, 1, 3	C000-C809	9410-9411, 9420-9421, 9424	07
3.1.2 Glioblastoma and anaplastic astrocytoma	0, 1, 3	C000-C809	9401, 9440-9442	08
3.1.3 Astrocytoma, NOS	0, 1, 3	C000-C809	9400	09
3.2 Other glioma	0, 1, 3	C000-C722, C724-C809	9380	10
	0, 1, 3	C000-C809	9381-9384, 9423, 9430, 9450-9451, 9460	10
3.3 Ependymoma	0, 1, 3	C000-C809	9391-9394	11
3.4. Medulloblastoma and other PNET				
3.4.1 Medulloblastoma	0, 1, 3	C716	9470-9474	12
3.4.2 Supratentorial PNET	0, 1, 3	C000-C715, C717-C809	9470-9474	13

SITE GROUP	ICD-O-3 BEHAVIOR RECODE	PRIMARY SITE	ICD-O-3 HISTOLOGY	RECODE
3 CNS and Other Intracranial and Intraspinal Neoplasms (all behaviors) *continued*				
3.5 Other specified intracranial and intraspinal neoplasms	0, 1, 3	C000-C699, C730-C750, C754-C809	9350-9351, 9360-9362, 9390, 9480, 9530-9535, 9537-9539, 9541, 9550, 9562, 9570	14
	0, 1, 3	C700-C729, C751-C753	9161, 9361-9362, 9390, 9530-9531, 9535, 9538, 9540, 9560, 9571	14
	0, 1, 3	C700	9532, 9534, 9537, 9539	14
	0, 1, 3	C753	9360	14
	0, 1, 3	C711	9480, 9539	14
	0, 1, 3	C713	9480, 9533	14
	0, 1, 3	C719	9350	14
	0, 1, 3	C714,C717	9480	14
	0, 1, 3	C709	9539	14
3.6 Unspecified intracranial and intraspinal neoplasms				
3.6.1 Unspecified malignant intracranial and intraspinal neoplasms	3	C700-C729, C751-C753	8000-8005	15
3.6.2 Unspec. ben/border intracran. and intraspin. Neo.	0, 1	C700-C729, C751-C753	8000-8005	16
4 Osseous & Chondromatous Neoplasms				
4.1 Osteosarcoma	3	C000-C809	9180-9187, 9192-9194	17
4.2 Chondrosarcoma	3	C000-C809	9220-9221, 9230-9231, 9240, 9242-9243	18
4.3 Ewing tumor	3	C000-C809	9260, 9364-9365	19
4.4 Other specified and unspecified bone tumors	3	C000-C809	8812, 9250, 9261, 9370-9372	20
	3	C400-C419	8000-8005, 8800-8803, 8805-8806, 9200	20
5 Soft Tissue Sarcomas				
5.1 Fibromatous neoplasms	3	C000-C809	8810-8811, 8813-8815, 8820-8824, 8830, 8832-8833, 8835-8836, 9252	21
5.2 Rhabdomyosarcoma	3	C000-C809	8900-8904, 8910, 8912, 8920-8921, 8991	22
5.3 Other soft tissue sarcoma				
5.3.1 Specified soft tissue sarcoma				
5.3.1.1 Specified (excluding Kaposi sarcoma)	3	C000-C809	8804, 8825, 8840-8897, 8982-8983, 8990, 9040-9044, 9120-9139, 9141-9150, 9170, 9251, 9561, 9580-9581	23
	3	C000-C699,C730-C750,C754-C809	9540, 9560, 9571	23

SITE GROUP	ICD-O-3 BEHAVIOR RECODE	PRIMARY SITE	ICD-O-3 HISTOLOGY	RECODE
5 Soft Tissue Sarcomas *continued*				
5.3.1.2 Kaposi sarcoma	3	C000-C809	9140	24
5.3.2 Unspecified soft tissue sarcoma	3	C000-C399, C420-C809	8800-8803, 8805-8806	25
6 Germ Cell and Trophoblastic Neoplasms				
6.1 Germ cell and trophoblastic neoplasms of gonads	3	C569, C620-C629	9060-9065, 9070-9073, 9080-9085, 9090-9091, 9100-9102, 9105	26
6.2 Germ cell and trophoblastic neoplasms of nongonadal sites				
6.2.1 Intracranial (all behaviors)	0, 1, 3	C700-C729, C751-C753	9060-9065, 9070-9073, 9080-9085, 9090-9091, 9100-9102, 9105	27
6.2.2 Other nongonadal	3	C000-C568, C570-C619, C630-C699, C730-C750, C754-C809	9060-9065, 9070-9073, 9080-9085, 9090-9091, 9100-9102, 9104-9105	28
7 Melanoma and Skin Carcinomas				
7.1 Melanoma	3	C000-C809	8720-8723, 8726, 8728, 8730, 8740-8746, 8761, 8770-8774, 8780	29
7.2 Skin carcinomas	3	C440-C449	8010-8589	30
8 Carcinomas				
8.1 Thyroid carcinoma	3	C739	8010-8589	31
8.2 Other carcinoma of head and neck				
8.2.1 Nasopharyngeal carcinoma	3	C110-C119	8010-8589	32
8.2.2 Other sites in lip, oral cavity and pharynx	3	C000-C109, C120-C148	8010-8589	33
8.2.3 Nasal cav, mid ear, sinuses, larynx, oth ill-def head/neck	3	C300-C329, C760	8010-8589	34
8.3 Carcinoma of trachea,bronchus, and lung	3	C330-C349	8010-8589	35
8.4 Carcinoma of breast	3	C500-C509	8010-8589	36
8.5 Carcinoma of genitourinary tract				
8.5.1 Carcinoma of kidney	3	C649	8010-8589	37
8.5.2 Carcinoma of bladder	3	C670-C679	8010-8589	38
8.5.3 Carcinoma of gonads	3	C569, C620-C629	8010-8589	39
	3	C000-C809	8590-8593	39
8.5.4 Carcinoma of cervix and uterus	3	C530-C559	8010-8589	40
8.5.5 Carc of other and ill-def sites, geniourinary tract	3	C510-C529, C570-C579, C600-C619, C630-C639, C659, C669, C680-C689	8010-8589	41

SITE GROUP	ICD-O-3 BEHAVIOR RECODE	PRIMARY SITE	ICD-O-3 HISTOLOGY	RECODE
8 Carcinomas *continued*				
8.6 Carcinoma of gastrointestinal tract				
8.6.1 Carcinoma of colon and rectum	3	C180-C218	8010-8589	42
8.6.2 Carcinoma of stomach	3	C160-C169	8010-8589	43
8.6.3 Carcinoma of liver and intrahepatic bile ducts	3	C220-C221	8010-8589	44
8.6.4 Carcinoma of pancreas	3	C250-C259	8010-8589	45
8.6.5 Carc other and ill-def sites, gastrointestinal tract	3	C150-C159, C170-C179, C230-C249, C260-C269	8010-8589	46
8.7 Carcinoma of other and ill-def sites				
8.7.1 Adrenocortical carcinoma	3	C740-C749	8010-8589	47
8.7.2 Carcinoma of other and ill-defined sites, NOS	3	C149,C219, C222-C229, C270-C299, C350-C439, C450-C499, C561-C568, C580-C599, C640-C648, C650-C658, C660-C668, C690-C738, C750-C759, C761-C809	8010-8589	48
	3	C809	9010	48
9 Miscellaneous specified neoplasms, NOS				
9.1 Other pediatric and embryonal tumors, NOS				
9.1.1 Wilms tumor	3	C000-C809	8959-8960	49
9.1.2 Neuroblastoma	3	C000-C809	9490, 9500	50
9.1.3 Other pediatric and embryonal tumors, NOS	3	C000-C809	8963-8964, 8970-8973, 8981, 9363, 9501-9523	51
9.2 Other specified and embryonal tumors, NOS				
9.2.1 Paraganglioma and glomus tumors	3	C000-C809	8680-8711	52
9.2.2 Other specified gonadal tumors	3	C000-C809	8600-8650, 9000	53
	3	C569	8670, 9013-9015, 9054	53
9.2.3 Myeloma, mast cell, misc. lymphoreticular neo., NOS	3	C000-C809	9724, 9731-9734, 9740-9741, 9743-9764, 9766, 9769, 9960, 9965-9967, 9970-9971	54

SITE GROUP	ICD-O-3 BEHAVIOR RECODE	PRIMARY SITE	ICD-O-3 HISTOLOGY	RECODE
9 Miscellaneous specified neoplasms, NOS *continued*				
9.2.4 Other specified neoplasms, NOS	3	C000-C809	8930-8951, 8980, 9020, 9050-9053, 9110, 9160, 9270-9330, 9950, 9961-9962, 9975, 9980, 9982, 9989, 9991-9992	55
	3	C000-C699, C730-C750, C754-C809	9161	55
10 Unspecified Malignant Neoplasms				
10 Unspecified Malignant Neoplasms	3	C000-C399, C420-C699, C730-C750, C754-C809	8000-8005	56
Unclassified				99

AYA Site Recode ICD-O-3/WHO 2008 Definition*^
The information provided in this table is also available in an ASCII text file (semicolons are used as the delimiters). To see how this variable is used with SEER data and the other AYA variable definition, see the AYA Site Recode home page.

* This table was updated for Hematopoietic codes based on WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues (2008).
^ Subject to change based on evolving ICD-O-3 coding rules.
AYA Site Recode ICD-O-3/WHO 2008 http://www.seer.cancer.gov/ayarecode/aya-who2008.html 6/26/2013

APPENDIX C: DEFINITIONS OF AYA CANCER SITES BY CHAPTER

CHAPTER TITLE	AYA SITE RECODE NAME	AYA SITE RECODE
Bone and Other Soft Tissue Sarcomas	Osteosarcoma Ewing Tumor Other Soft Tissue Sarcoma-excl Kaposi Sarcoma	17 19 23
Brain and Central Nervous System	Specified Low-Grade Astrocytoma Glioblastoma and Anaplastic Astrocytoma Astrocytoma NOS Other Glioma Ependymoma Medulloblastoma Supratentorial PNET Other Specified Intracranial and Intraspinal Neoplasms Unspec malignant intracranial and intraspinal neo Unspec ben/border intracran. and intraspin neo	7 8 9 10 11 12 13 14 15 16
Breast	Carcinoma of Breast	36
Cervix	Cervix Carcinoma of Cervix and Uterus (Cervix only)	40 (site2=530-539)
Colon and Rectum	Carcinoma of Colon and Rectum	42
Kaposi's Sarcoma	Kaposi Sarcoma	24
Kidney	Carcinoma of kidney	37
Leukemia	Acute Lymphoid Leukemia Acute Myeloid Leukemia Chronic Myeloid Leukemia	01 02 03
Lip, Oral Cavity and Pharynx	Other Sites in Lip, Oral Cavity and Pharynx	33
Lung	Carcinoma of trachea, bronchus, and lung	35
Lymphoma: Hodgkin	Hodgkin Lymphoma	06
Lymphoma: Non-Hodgkin	Non-Hodgkin Lymphoma	05
Melanoma	Melanoma	29
Ovary	Germ cell and trophoblastic neoplasms of gonads (females only) Carcinoma of gonads (females only)	39 (sex=2) 39 26 (sex=2)
Stomach	Carcinoma of stomach	43
Testis	Carcinoma of gonads (males only) Germ cell and trophoblastic neoplasms of gonads (males only)	26 (sex=1) 39 (sex=1)
Thyroid	Thyroid Carcinoma	31
Uterus	Carcinoma of Cervix and Uteri (Uteri only)	40 (site2=540-559)

APPENDIX D: DATA SELECTION CRITERIA FOR SUPPLEMENTAL GRAPHS

CHAPTER TITLE AND GRAPH DETAILS	DESCRIPTION OF CASE SELECTION*
Bone and Other Soft Tissue Sarcomas	
A. Bone	AYA site recode: 17, 19
B. Other Soft Tissue Sarcomas	AYA site recode: 23
Kaposi's Sarcoma	
A. Year 1988-1995	Year of Diagnosis: 1988-1995
B. Year 1996-2014	Year of Diagnosis: 1996-2014
Leukemia	
A. Acute Lymphoid Leukemia	AYA site recode: 1
B. Acute Myeloid Leukemia	AYA site recode: 2
C. Chronic Myeloid Leukemia	AYA site recode: 3
Lung	
Adenocarcinoma	Histology: 8015, 8050, 8140, 8141, 8143, 8144, 8145, 8147, 8190, 8201, 8211, 8250, 8251, 8252, 8253, 8254, 8255, 8260, 8290, 8310, 8320, 8323, 8333, 8401, 8440, 8470, 8471, 8480, 8481, 8490, 8503, 8507, 8550, 8570, 8571, 8572, 8574, 8576
Squamous Transitional	Histology: 8051, 8052, 8070, 8071, 8072, 8073, 8074, 8075, 8076, 8078, 8083, 8084, 8090, 8094, 8120, 8123
Small Cell	Histology: 8002, 8041, 8042, 8043, 8044, 8045
Large Cell	Histology: 8012, 8013, 8014, 8021, 8034, 8082
Other Carcinoma	Histology: 8010, 8020, 8022, 8031, 8032, 8046, 8200, 8246, 8370, 8430, 8560
Carcinoid	Histology: 8240, 8249
Hodgkin Lymphoma	
Mixed Cellularity	Histology: 9652
Lymphocyte Depletion	Histology: 9653, 9654, 9655
Nodular Sclerosis	Histology: 9663, 9664, 9665, 9667
Other	Histology: 9650, 9651, 9659, 9661, 9662
Non-Hodgkin Lymphoma	
Follicular	Histology: 9690, 9691, 9692, 9693, 9694, 9695, 9696, 9697, 9698
Diffuse Large B Cell	Histology: 9680
Testis	
A. Seminoma	Histology: 9060, 9061, 9062, 9064
B. Non-Seminoma	Histology: 9065, 9070, 9071, 9080, 9081, 9082, 9083, 9084, 9085, 9100, 9101, 9102

* Histology codes are based on ICD-O-3.

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