CANCER IN LOS ANGELES COUNTY:

Liver Cancer

Incidence, Mortality, and Survival

2000-2017

LOS ANGELES COUNTY Cancer Surveillance Program

USC Norris Comprehensive Cancer Center
Keck Medicine of USC

Keck School of Medicine of USC

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CSP website: https://csp.usc.edu

Cancer data access portal for Los Angeles County + all California

https://explorer.ccrcal.org

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As the most populous county in the United States with more than 10 million racially and ethnically diverse residents, Los Angeles County is an ideal place for cancer research. The vast disparities in cancer risk among different population groups provide excellent opportunities to gain better understanding about the potential causes of each type of cancer, in order to develop better cancer control and prevention strategies. It was for this very reason, a group of visionary faculty researchers in the University of Southern California Medical School (now the Keck School of Medicine) established the Los Angeles Cancer Surveillance Program (CSP).

For the past 50 years, the CSP has become a leader on the national and international stages for cancer surveillance and cancer epidemiological research with multitudes of contributions to the field. The CSP cancer data and its diverse demographics are a gold mine of information for not only scientific research, teaching and training the next generation of public health professionals, but also for serving the community needs and building academic and community partnerships.

The CSP is a valued member and strong partner of the Norris Comprehensive Cancer Center whose aim is to make cancer a disease of the past, for which the CSP data plays a significant role. Likewise, the CSP is able to leverage the expertise of Cancer Center scientists to ensure data are well used to achieve cancer prevention and control. The CSP also partners with the Keck School of Medicine, the University of Southern California, and the larger communities beyond. CSP informational reports like this one underscore the CSP's commitment to serving its local communities for the ultimate goal of improving cancer prevention, detection, treatment, and survival.

This report was prepared by the following researchers: Lihua Liu, PhD, CSP Director and Associate Professor; Amie E. Hwang, PhD, cancer epidemiologist and Assistant Professor; Kai-Ya Tsai, statistician; James Huynh, research assistant; V. Wendy Setiawan, PhD, Associate Director for Population Sciences in the USC Research Center for Liver Diseases and Associate Professor; Anthony El-Khoueiry, MD, Director of Clinical Translation at the Southern California Clinical and Translational Science Institute (SC CTSI) and Associate Professor; Dennis Deapen, DrPH, epidemiologist and Professor.

The liver is the largest internal organ of a human body. It carries out many important bodily functions to sustain life. Liver cancer refers to primary cancer that starts in the liver. The different types of cells in the liver can form several types of malignant/cancerous tumors. These different tumors have different causes, are treated differently, and have different outcomes. Hepatocellular carcinoma is the most common form of liver cancer in adults.

In this report we included a total of 14,225 cases of primary liver cancer diagnosed among Los Angeles County residents during the period of 2000-2017.

- Of those, 71% are male, 51% are aged 65 years and older at diagnosis, 41% are diagnosed at localized stage, 60% of diagnoses are histologically confirmed, and 84% are of hepatocellular carcinoma subtype.
- Older age, Non-Hispanic Black and Thai/Hmong/Cambodian/Laotian racial/ethnic backgrounds, low socioeconomic status, and non-hepatocellular carinomia subtype are associated with later disease stage at diagnosis.
- The risk of developing or dying from liver cancer increases substantially with age and varies across racial/ethnic groups.
- Asian/Pacific Islanders have the highest incidence and mortality rates of liver cancer among all of the aggregated racial/ethnic groups. However, the variations in risk among the ethnic subgroups within the Asian/Pacific Islanders is even greater, with the highest rates found in Southeast Asians the lowest in South Asians.
- Although 2nd in incidence and mortality rates following Asian/Pacific Islanders, individuals of Hispanic origin form the largest group of newly diagnosed liver cancer patients, as a result of the combined effects of their risk level and large population size.
- In contrast to the declining trends in both incidence and mortality among Asian/Pacific Islanders, Hispanics experience steady incidence trends and slightly rising mortality trends in both men and women. In 2017, Hispanic women have the highest mortality rate among all racial/ethnic groups.
- Decreasing trends in both age-adjusted incidence and mortality rates are observed only in Asian/Pacific Islanders.
- Being female, younger age, higher socioeconomic status and earlier stage at diagnosis are associated with better survival. Asian/Pacific Islanders and Hispanics have better survival than either the Non-Hispanic Whites or Non-Hispanic Blacks. The survival advantage of hepatocellular carcinoma subtype over non-hepatocellular carcinoma subtype appears to diminish over time.

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 3 such regional registries collectively providing statewide cancer surveillance. In 1992, the CSP joined the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) program. This consortium of 16 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 47,000 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 10,000 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 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 (CDC) National Program of Cancer Registries, under cooperative agreement 5NU58DP006344; the National Cancer Institute's Surveillance, Epidemiology and End Results Program under contract HHSN261201800032I awarded to the University of California, San Francisco, contract HHSN261201800015I awarded to the University of Southern California, and contract HHSN261201800009I awarded to the Public Health Institute. The ideas and opinions expressed herein are those of the authors 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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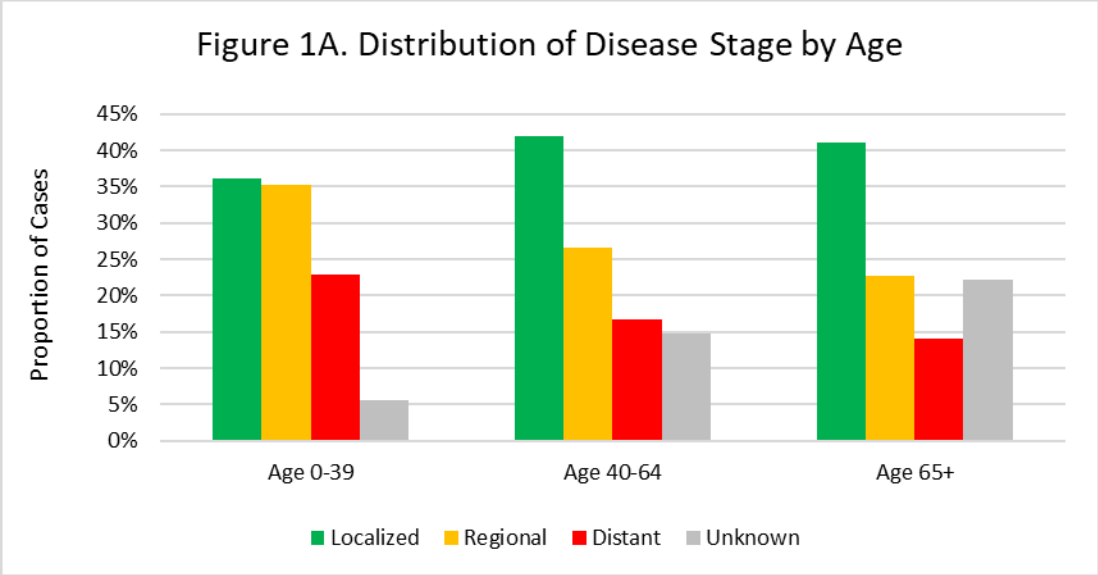
INCIDENCE

Table 1. Frequency and Distribution of Invasive Liver Cancer Cases by Age, Race/Ethnicity, Socioeconomic Status, Disease Stage and Subtype, Los Angeles County, 2000-2017.

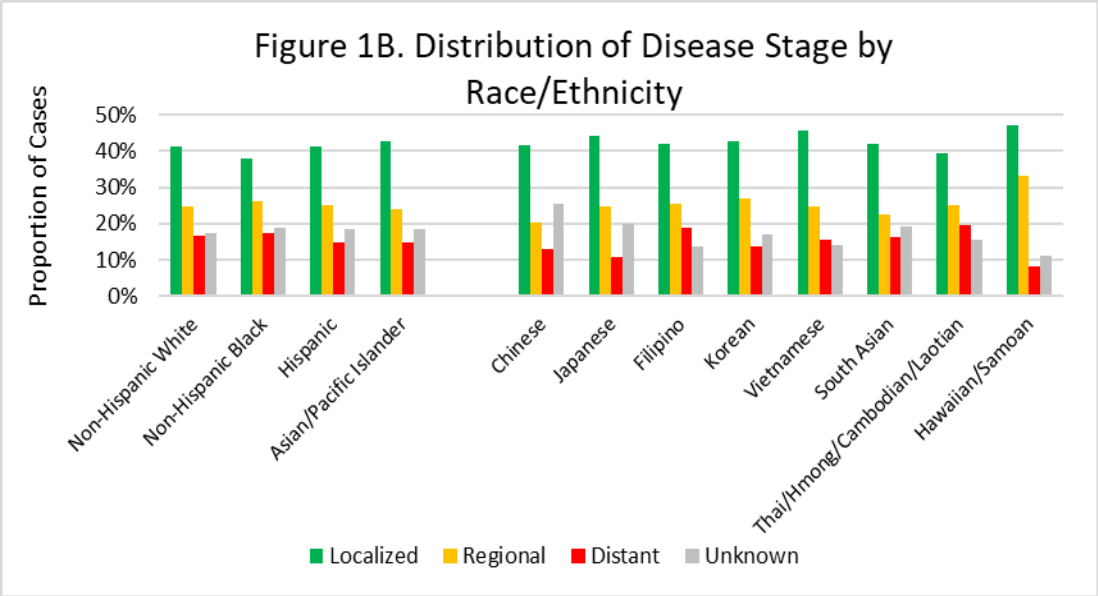
	Male		Female		Male and Female	
	N	%	N	%	N	%
Age (years)						
0-39	228	2	129	3	357	3
40-64	5,278	52	1,287	31	6565	46
≥65	4,598	46	2,705	66	7303	51
Race/Ethnicity						
Non-Hispanic White	2,829	28	1,004	24	3833	27
Non-Hispanic Black	1,075	11	411	10	1486	10
Hispanic	3,575	35	1,581	38	5156	36
Asian/Pacific Islander	2,552	25	1,101	27	3653	26
Other/Missing	73	1	24	1	97	1
Asian/Pacific Islander Ethnicity						
Chinese	772	8	330	8	1102	8
Japanese	133	1	117	3	250	2
Filipino	447	4	186	5	633	4
Korean	524	5	230	6	754	5
Vietnamese	343	3	116	3	459	3
South Asian	47	<1	15	<1	62	<1
Thai/Hmong/Cambodian/Laotian	172	2	58	1	230	2
Hawaiian/Samoan	25	<1	11	<1	36	<1
Socioeconomic Status						
Highest	1,262	12	515	12	1777	12
Upper-Middle	1,710	17	696	17	2406	17
Middle	2,012	20	771	19	2783	20
Lower-Middle	2,477	25	991	24	3468	24
Lowest	2,643	26	1,148	28	3791	27
Disease Stage						
Localized	4,105	41	1,774	43	5879	41
Regional	2,634	26	895	22	3529	25
Distant	1,654	13	551	13	2205	16
Unknown	1,711	87	901	22	2612	18
Diagnostic Confirmation						
Histologically confirmed	6,041	60	2,456	60	8497	60
Radiographically confirmed	2,708	27	940	23	3648	26
Other	1,355	13	725	18	2080	15
Subtype						
Hepatocellular carcinoma	8,819	87	3,200	78	12019	84
Other (Non-Hepatocellular carcinoma)	1,285	13	921	22	2206	16
Total	**10,104**	**71**	**4,121**	**29**	**14225**	**100**

Of the 14,225 liver cancer patients diagnosed among Los Angeles County residents during 2000-2017, 71% of them are male, 51% aged 65 years and older, 36% are Hispanic followed by 27% Non-Hispanic White and 26% Asian/Pacific Islander, are more of lower socioeconomic status, 41% are diagnosed at localized stage, 60% of diagnoses are histologically confirmed, and 84% are of hepatocellular carcinoma subtype.

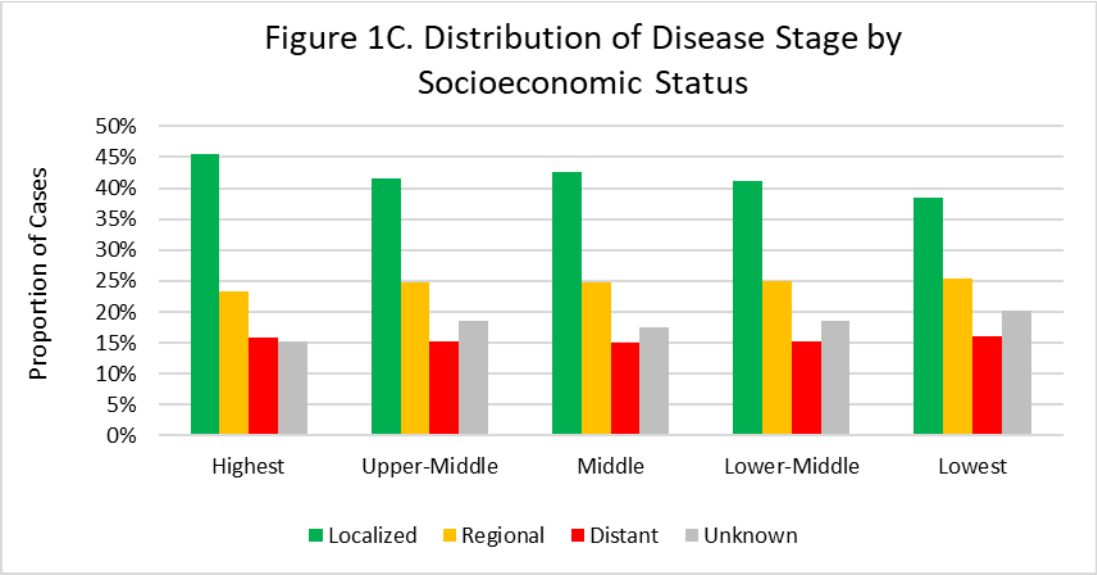
Figure 1. Disease Stage Distribution of Invasive Liver Cancer by Age, Race/ Ethnicity and Socioeconomic Status, Los Angeles County, 2000-2017.



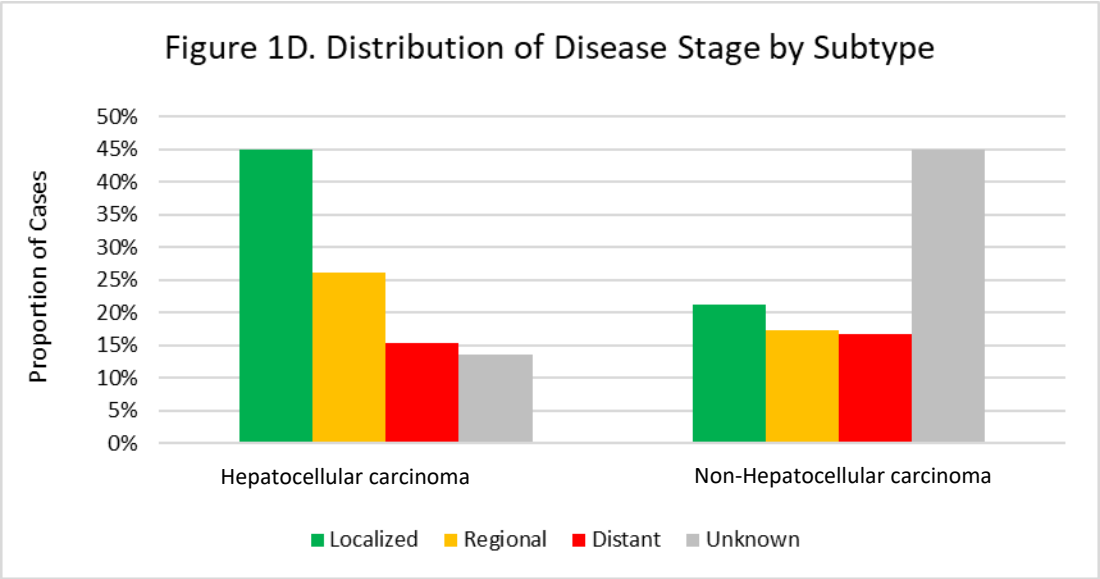
Overall, less than 45% of liver cancers are diagnosed at localized stage. The youngest age group (0-39 years old) has the lowest proportion of early stage diagnoses (36% localized), but highest for regional (35%) and distant (23%) stages.



Patients of Non-Hispanic Black (38%) and Thai/Hmong/Cambodian/Laotian (40%) backgrounds have the lowest proportion of being diagnosed at localized stage.

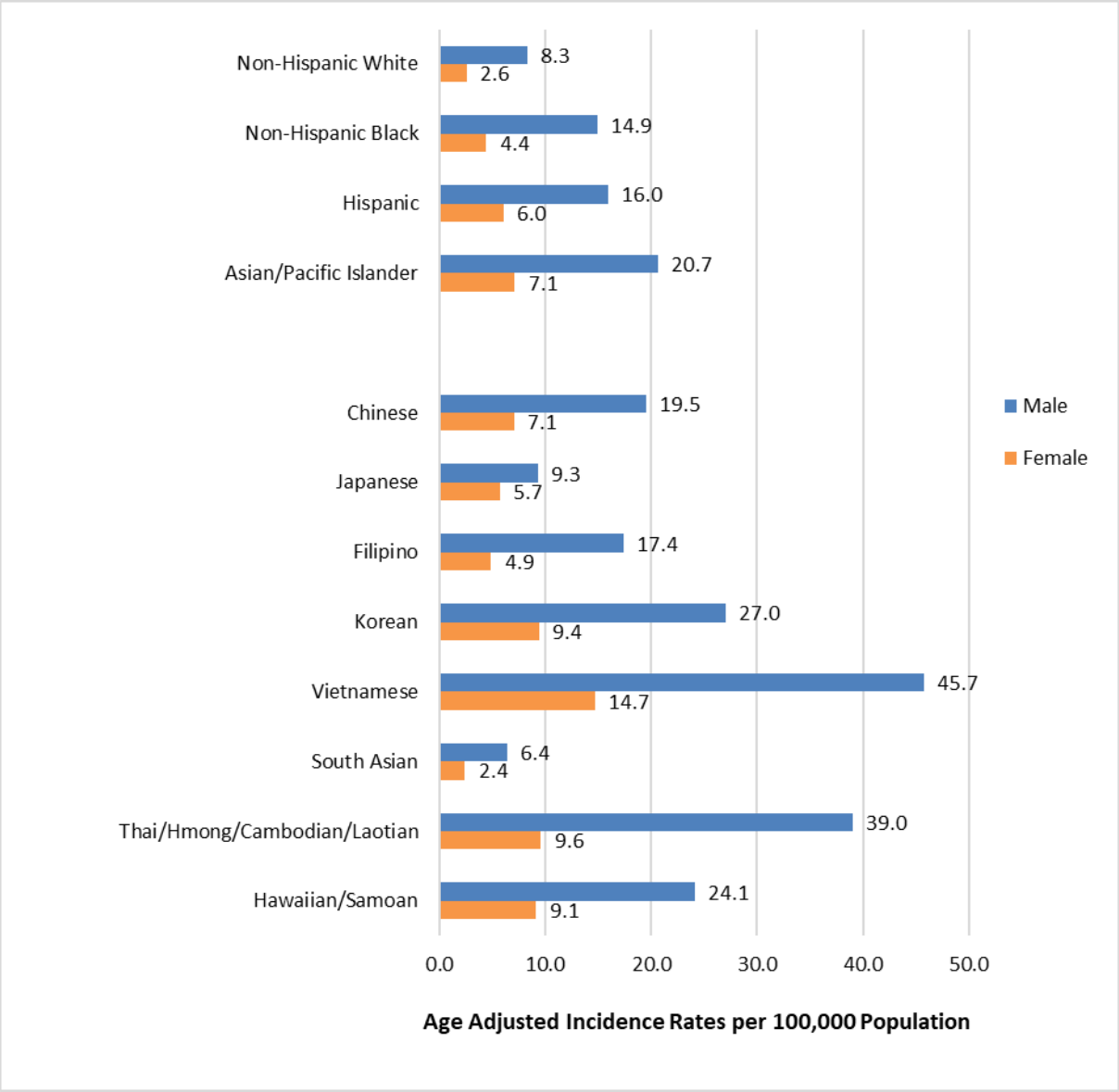


The higher socioeconomic status group displayed only slight advantages for early diagnosis as compared to the lowest socioeconomic status group.



The stage distribution varies greatly by subtype of liver cancer. As the majority of liver cancer, hepatocellular carcinoma has a much better chance to be diagnosed at localized stage than other subtypes (45% vs. 21%).

Figure 2. Age-Adjusted Incidence Rates of Invasive Liver Cancer by Race/ Ethnicity and Sex (per 100,000 population), Los Angeles County, 2000-2017.

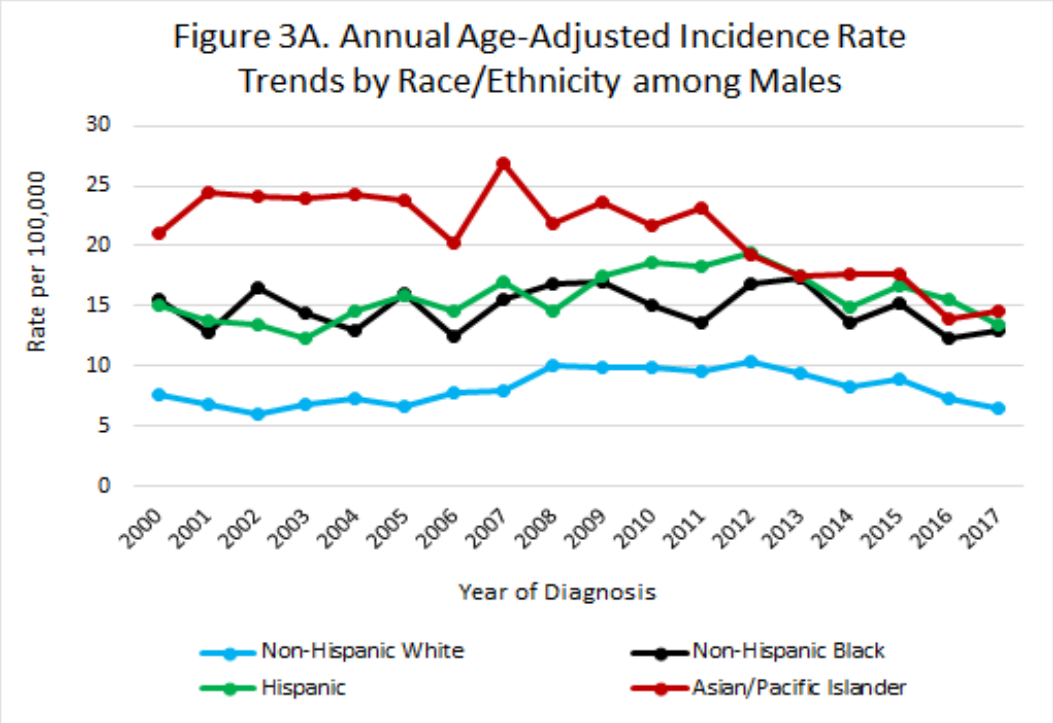


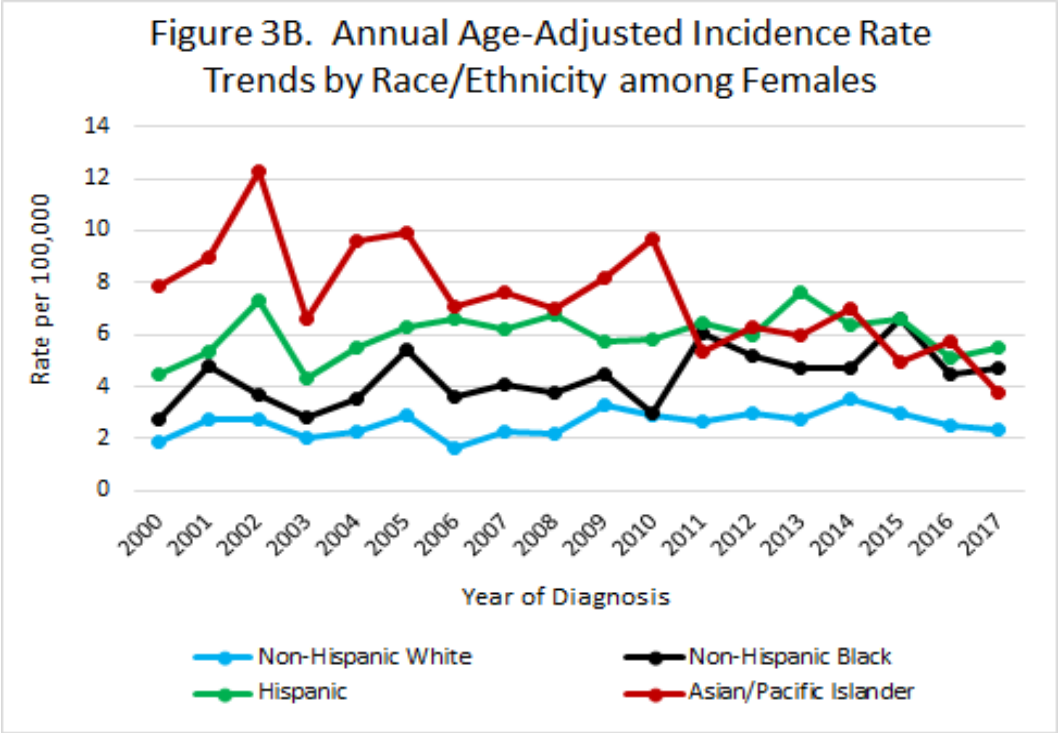
The risk of developing liver cancer varies across racial/ethnic groups.

Asian/Pacific Islanders have the highest incidence rates of liver cancer among all of the racial/ethnic groups, regardless of sex. However, the variations in incidence rates among the ethnic subgroups within Asian/Pacific Islanders are even greater. For example, the age-adjusted incidence rates range from the lowest of 2.4 per 100,000 in South Asian women to the highest of 45.7 per 100,000 in Vietnamese men.

Men have a much higher risk of developing liver cancer than women. The sex differences are larger among Southeast Asians (Vietnamese, Thai/Hmong/Cambodian/Laotian, Filipino) than East Asians (Japanese, Chinese, Korean).

Figure 3. Annual Age-Adjusted Incidence Rate Trends of Invasive Liver Cancer by Race/Ethnicity and Sex (per 100,000 population), Los Angeles County, 2000-2017.

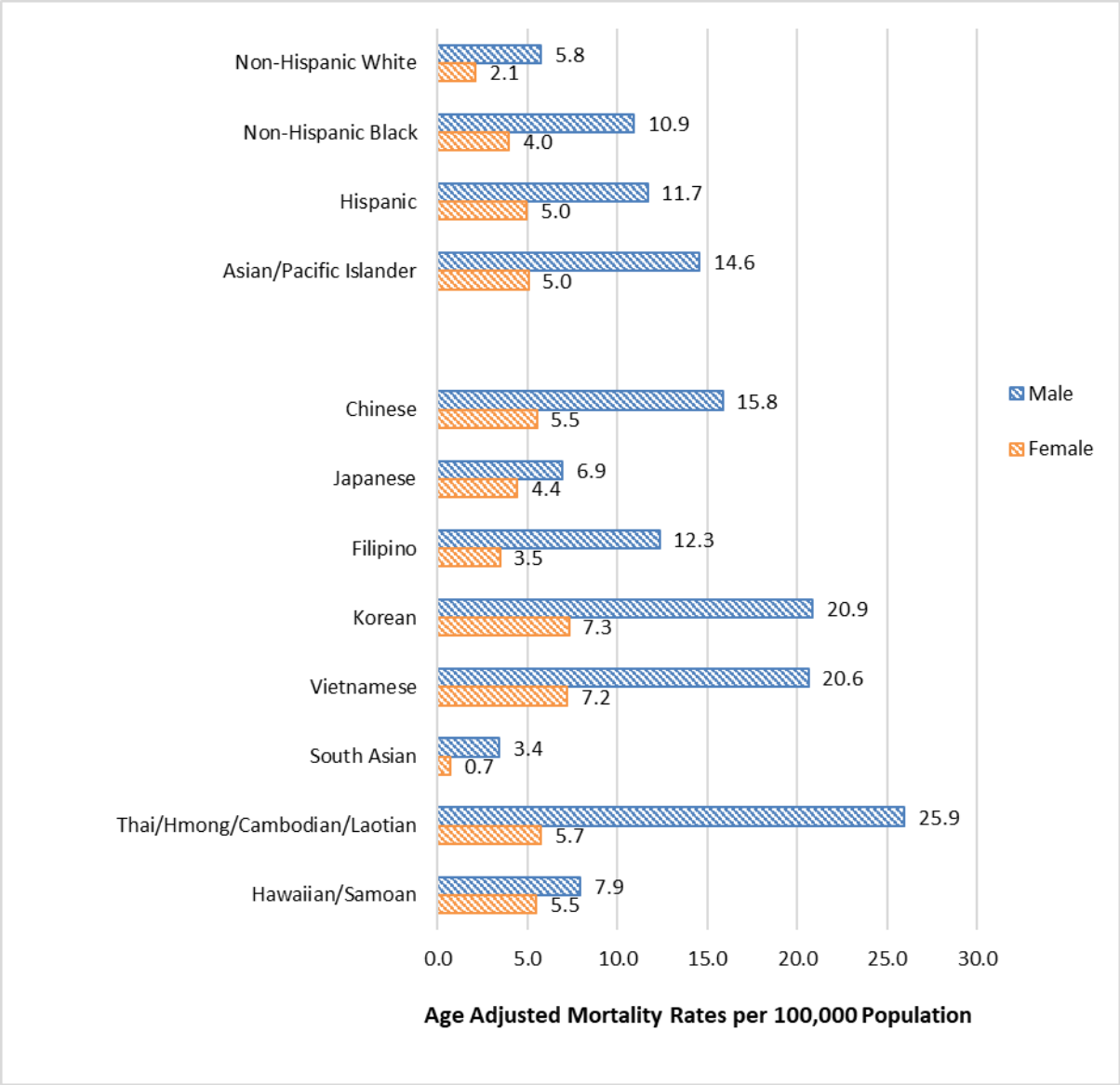




Although with different rate levels, men and women share very similar incidence rate trends by race/ethnicity, with decreasing trends only among Asian/Pacific Islanders.

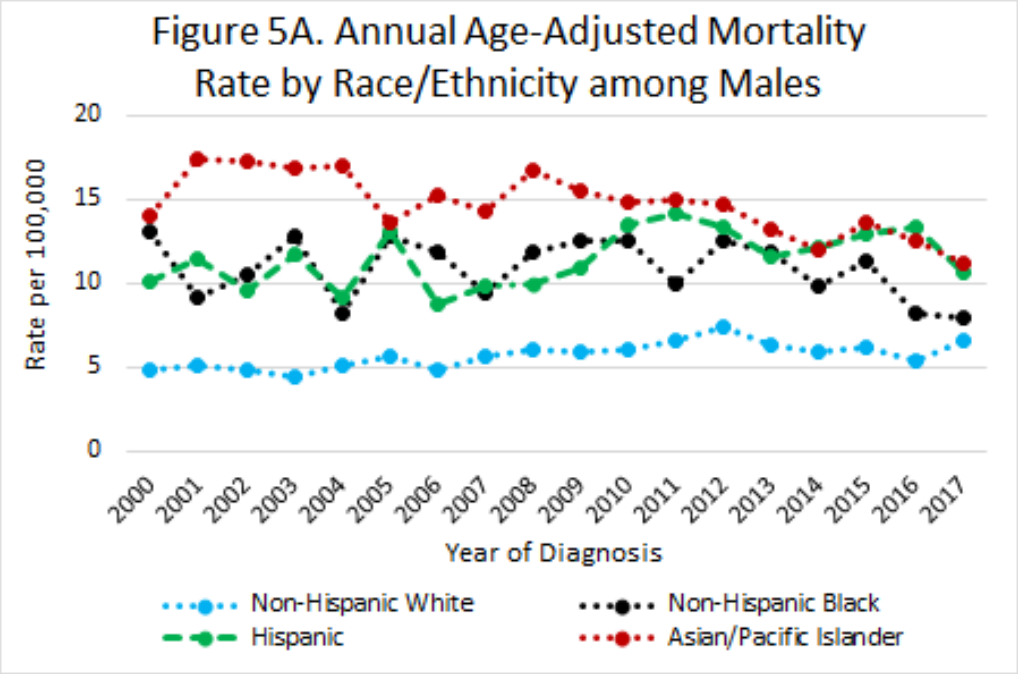
MORTALITY

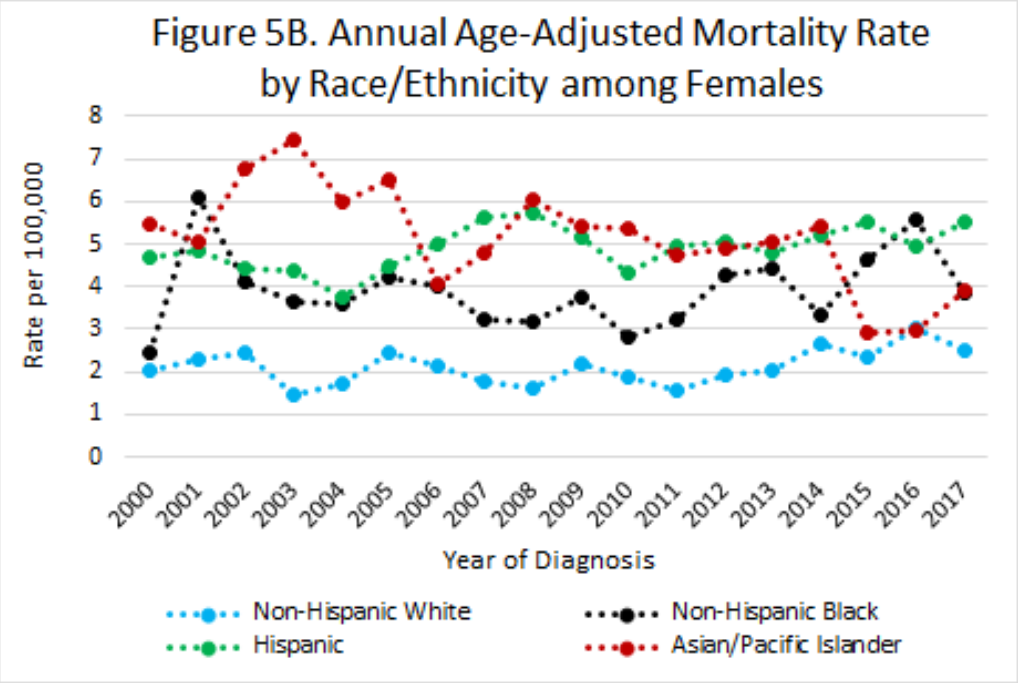
Figure 4. Age-Adjusted Mortality Rates of Liver Cancer by Race/Ethnicity and Sex (per 100,000 population), Los Angeles County, 2000-2017.



Similar to incidence, liver cancer mortality also varies greatly by race/ethnicity. The highest liver cancer mortality rate is 25.9 per 100,000 among Thai/Hmong/Cambodian/Laotian men and the lowest is 0.7 per 100,000 among South Asian women.

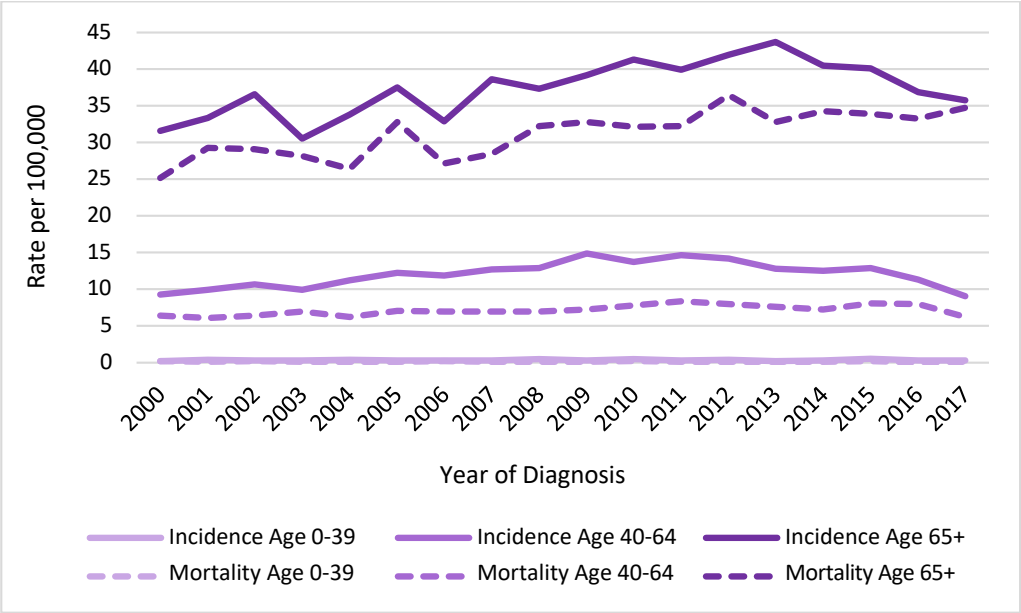
Figure 5. Annual Age-Adjusted Mortality Rate Trends of Liver Cancer by Race/Ethnicity and Sex (per 100,000 population), Los Angeles County, 2000-2017.





Similar to incidence rate trends, decreasing liver cancer mortality trends are observed in Asian/Pacific Islander men and women. For other racial/ethnic groups, liver cancer mortality fluctuate but remain largely unchanged during 2000-2017.

Figure 6. Comparison of Time Trends in Annual Age-Adjusted Incidence vs. Mortality Rates of Liver Cancer by Age Group (per 100,000 population), Los Angeles County, 2000-2017.



Like most cancers, the risk of developing or dying from liver cancer increases with age and are very low for people under 40 years old. Although incidence rates are generally higher than mortality rates, both share similar trends. Rising trends in both incidence and mortality rates are observed for people aged 65 years and older, for which a recent decline is observed only in incidence trend, not in mortality.

SURVIVAL

Table 2. One- and Five-year Observed Survival among Invasive Liver Cancer Patients by Sex, Age, Race/Ethnicity, Socioeconomic Status, Disease Stage, and Subtype, Los Angeles County, 2000-2017.

	Male				Female			
	1-Year		5-Year		1-Year		5-Year	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Age (years)								
0-39	61.3	54.4-67.5	42.3	35.0-49.3	71.0	62.1-78.2	56.5	46.8-65.1
40-64	43.3	41.9-44.7	17.0	15.9-18.2	52.2	49.3-55.0	25.3	22.7-27.9
≥65	39.1	37.6-40.5	10.6	9.6-11.6	37.9	36.0-39.8	10.5	9.2-11.9
Race/Ethnicity								
Non-Hispanic White	40.5	38.6-42.3	13.8	12.4-15.2	38.3	35.2-41.4	15.2	12.8-17.8
Non-Hispanic Black	34.3	31.3-37.2	10.4	8.4-12.6	34.1	29.4-38.8	10.5	7.5-14.1
Hispanic	41.1	39.5-42.8	13.1	11.9-14.4	44.3	41.7-46.8	15.8	13.8-18.0
Asian/Pacific Islander	47.0	45.0-48.9	19.4	17.8-21.2	50.9	47.8-54.0	21.5	18.9-24.2
Asian/Pacific Islander Ethnicity								
Chinese	51.8	48.1-55.4	21.8	18.6-25.1	51.3	45.6-56.7	21.1	16.4-26.2
Japanese	44.2	35.3-52.6	23.1	15.9-31.1	47.9	38.3-56.9	14.3	8.4-21.8
Filipino	36.8	32.2-41.3	15.3	11.8-19.1	43.6	36.0-51.0	15.0	9.5-21.6
Korean	51.7	47.2-56.0	18.4	15.0-22.2	58.3	51.4-64.5	27.7	21.6-34.1
Vietnamese	47.3	41.8-52.6	23.6	18.8-28.6	51.5	41.9-60.3	26.4	18.4-35.1
South Asian	51.7	36.0-65.3	14.6	5.6-27.7	51.9	24.5-73.6	33.3	10.0-59.2
Thai/Hmong/Cambodian/Laotian	34.3	27.1-41.6	7.7	4.0-13.1	41.0	27.8-53.7	24.5	13.2-37.5
Hawaiian/Samoan	34.4	16.0-53.7	14.8	2.9-35.5	60.0	25.3-82.7	10.0	0.6-35.8
Socioeconomic Status								
Highest	49.5	46.6-52.3	21.4	19.0-23.9	50.6	46.1-55.0	22.4	18.5-26.5
Upper-Middle	46.0	43.6-48.4	17.9	15.9-19.9	46.2	42.3-50.0	18.5	15.3-21.9
Middle	41.4	39.2-43.7	13.7	12.0-15.4	43.3	39.7-46.9	16.8	14.0-19.9
Lower-Middle	41.4	39.4-43.4	14.7	13.2-16.3	39.5	36.4-42.7	15.5	13.0-18.1
Lowest	35.8	33.9-37.7	9.8	8.6-11.2	42.3	39.3-45.3	14.0	11.8-16.4
Disease Stage								
Localized	63.8	62.3-65.3	26.6	25.1-28.2	62.8	60.4-65.0	27.9	25.6-30.2
Regional	35.1	33.2-36.9	9.8	8.6-11.0	40.6	37.3-43.9	13.0	10.7-15.6
Distant	14.1	12.4-15.8	2.6	1.9-3.6	16.0	13.0-19.2	4.3	2.7-6.4
Unknown	23.0	20.9-25.3	3.8	2.8-5.0	21.1	18.2-24.2	3.4	2.1-5.2
Subtype								
Hepatocellular Carcinoma	43.6	42.6-44.7	14.9	14.0-15.7	46.9	45.1-48.6	17.6	16.1-19.1
Other (Non-Hepatocellular Carcinoma)	27.7	25.1-30.4	13.3	11.2-15.4	30.5	27.3-33.7	13.2	10.8-15.9

CI: Confidence Interval

The observed survival of liver cancer patients showed younger age, higher socioeconomic status, and earlier stage at diagnosis are associated with better survival in both men and women. Asian/Pacific Islanders have the highest survival rates compared to other racial/ethnic groups, while ethnic variations existed among Asian/Pacific Islander subgroups. The survival advantage of hepatocellular carcinoma subtype over other, non-hepatocellular carcinoma subtypes appears to diminish over time.

Table 3. One- and Five-year Relative* Survival among Invasive Liver Cancer Patients by Sex, Age, Race/Ethnicity, Socioeconomic Status, Disease Stage, and Subtype, Los Angeles County, 2000-2017.

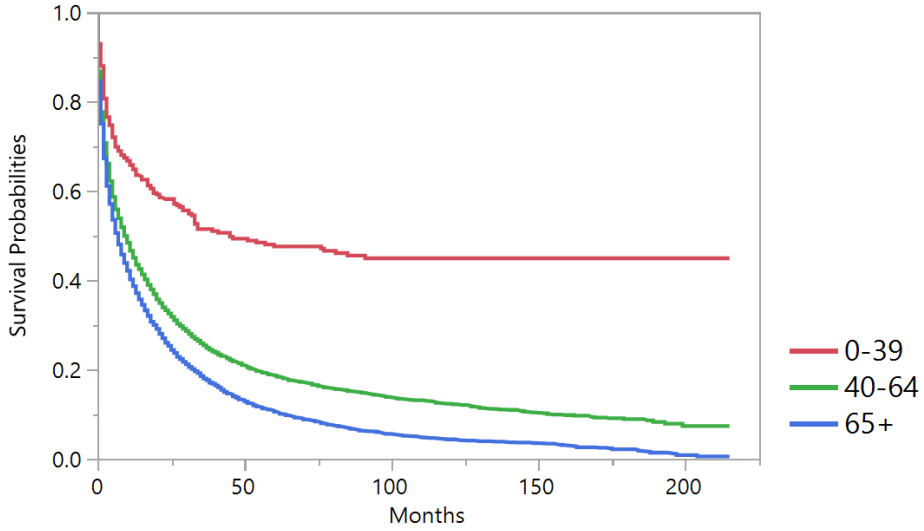
	Male				Female			
	1-Year		5-Year		1-Year		5-Year	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Age (years)								
0-39	62.1	55.1-68.3	43.8	36.4-51.0	72.8	63.9-79.9	57.5	47.7-66.1
40-64	45.9	44.5-47.3	19.1	17.9-20.4	54.4	51.4-57.3	28.6	25.7-31.6
≥65	42.1	40.5-43.8	14.6	13.2-16.1	40.4	38.2-42.5	13.3	11.6-15.1
Race/Ethnicity								
Non-Hispanic White	43.3	41.2-45.3	17.5	15.8-19.4	41.5	37.9-45.0	19.0	15.9-22.3
Non-Hispanic Black	38.2	34.8-41.5	12.7	10.1-15.5	37.9	32.6-43.1	13.9	9.9-18.6
Hispanic	44.0	42.2-45.8	16.2	14.7-17.7	46.9	44.1-49.6	19.4	17.0-22.0
Asian/Pacific Islander	49.2	47.1-51.3	22.2	20.2-24.2	52.2	48.9-55.5	24.4	21.3-27.6
Asian/Pacific Islander Ethnicity								
Chinese	54.7	50.8-58.4	25.4	21.7-29.3	51.4	45.2-57.2	24.5	19.1-30.4
Japanese	47.0	37.1-56.2	26.8	18.0-36.3	49.1	39.0-58.5	13.1	7.1-21.1
Filipino	38.4	33.5-43.3	17.2	13.1-21.7	42.9	34.5-51.0	15.7	9.3-23.5
Korean	53.7	48.9-58.2	20.1	16.2-24.3	60.5	53.2-67.0	32.1	25.1-39.3
Vietnamese	49.2	43.4-54.8	26.6	21.0-32.4	55.3	44.6-64.6	29.0	19.7-38.9
South Asian	54.9	38.0-69.0	17.2	6.5-32.2	50.4	18.4-75.7	38.3	10.0-67.0
Thai/Hmong/Cambodian/Laotian	35.8	28.4-43.2	8.8	4.6-14.6	46.0	31.9-59.0	29.1	16.2-43.3
Hawaiian/Samoan	36.1	16.3-56.5	13.0	2.4-32.9	50.1	11.1-80.4	17.0	0.8-52.4
Socioeconomic Status								
Highest	54.0	50.8-57.0	26.5	23.6-29.6	53.9	48.8-58.8	29.5	24.5-34.6
Upper-Middle	49.4	46.7-52.0	21.9	19.5-24.4	48.1	43.8-52.3	21.8	17.9-25.8
Middle	44.4	42.0-46.8	17.1	15.0-19.2	45.1	41.1-49.1	19.2	15.7-22.9
Lower-Middle	43.7	41.6-45.9	17.2	15.4-19.1	43.4	39.9-46.8	18.6	15.7-21.8
Lowest	38.4	36.3-40.5	12.2	10.7-13.9	44.9	41.6-48.1	17.1	14.5-20.0
Disease Stage								
Localized	66.9	65.3-68.5	32.4	30.5-34.2	66.4	63.9-68.9	34.6	31.8-37.5
Regional	39.2	37.2-41.2	12.4	10.9-14.0	44.0	40.4-47.6	15.4	12.6-18.5
Distant	16.2	14.4-18.2	3.4	2.4-4.7	18.6	15.2-22.3	4.6	2.8-7.2
Unknown	25.7	23.3-28.2	4.9	3.6-6.4	22.9	19.7-26.3	4.1	2.5-6.4
Subtype								
Hepatocellular Carcinoma	46.7	45.5-47.8	18.3	17.3-19.3	49.5	47.5-51.4	21.3	19.5-23.1
Other (Non-Hepatocellular Carcinoma)	31.2	29.0-33.5	15.2	13.4-17.1	33.8	30.3-37.4	15.9	13.0-19.0

CI: Confidence Interval
* Relative survival estimates the probability of survival from cancer considering the chances of dying from other causes. It is calculated as a ratio of the observed survival among cancer patients to the expected survival from all causes of death.

The relative survival of liver cancer tends to be slightly higher than the observed survival due to the consideration of the underlying mortality from causes other than liver cancer. But the patterns by patient and tumor characteristics between relative survival and observed survival are consistently similar.

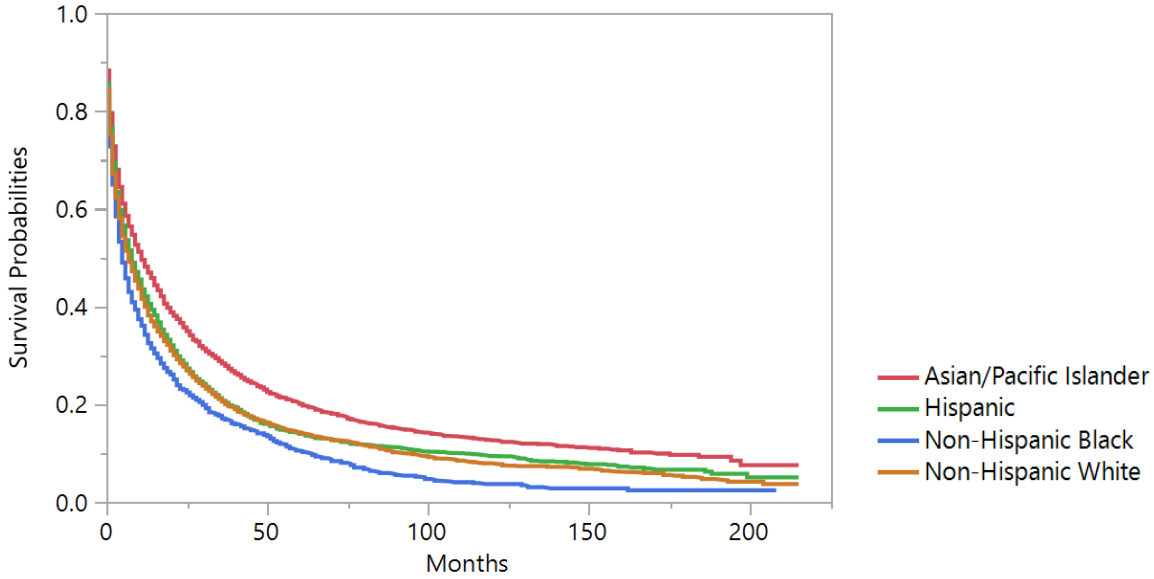
Figure 7. Kaplan-Meier Observed Survival Curves for Invasive Liver Cancer by Age, Race/Ethnicity, Socioeconomic Status, Stage and Subtype, Los Angeles County, 2000-2017.

Figure 7A. Kaplan-Meier Survival Curves by Age



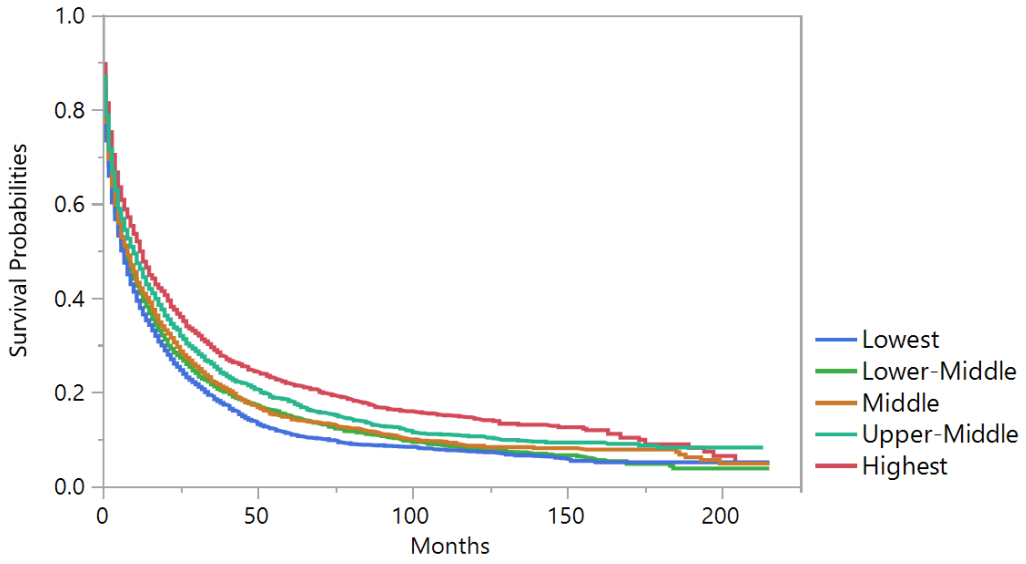
The liver cancer survival probability worsened with older age. The youngest age group (0-39 years of age) has the best survival.

Figure 7B. Kaplan-Meier Survival Curves by Race/Ethnicity



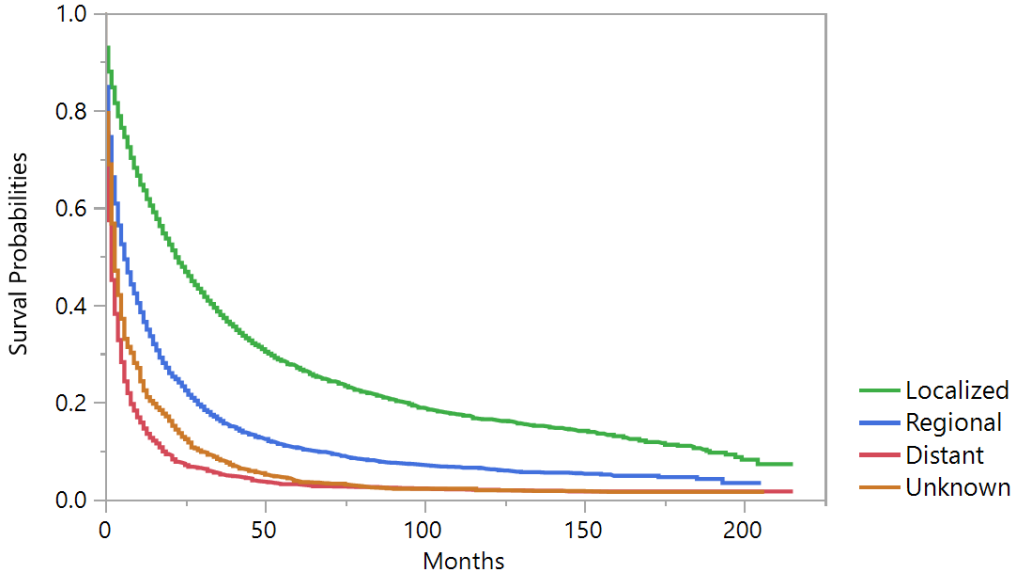
Asian/Pacific Islanders has the best survival over time, while Non-Hispanic Blacks has the worst.

Figure 7C. Kaplan-Meier Survival Curves by Socioeconomic Status



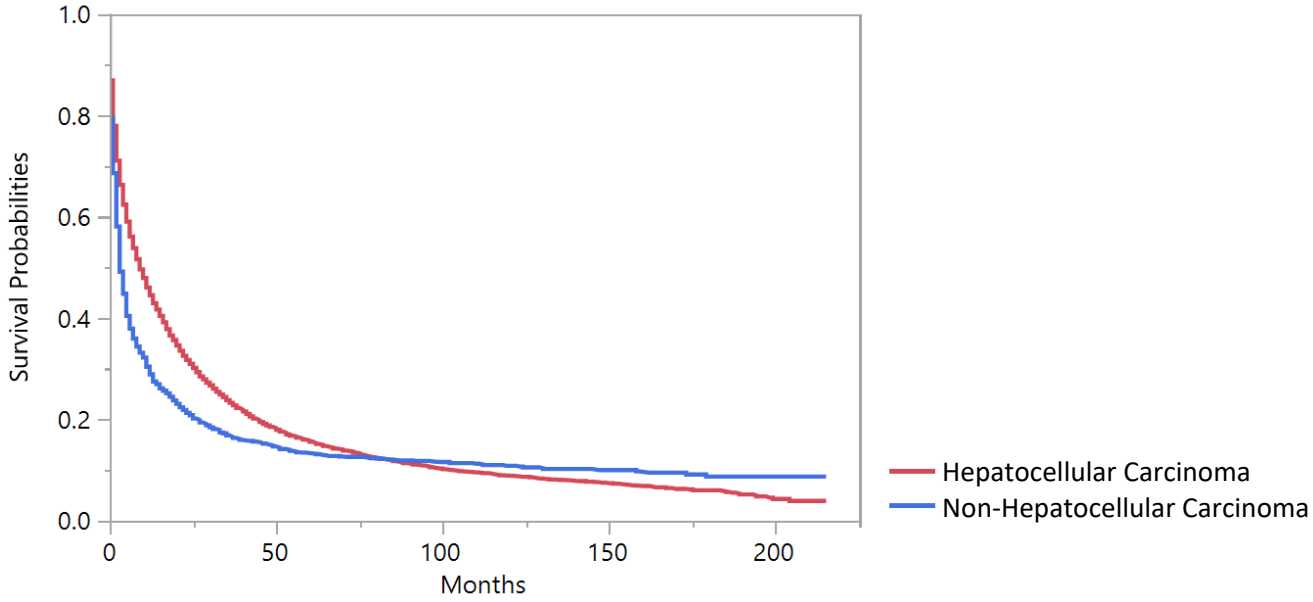
Patients of the highest socioeconomic status has a slight survival advantage over other groups and the lowest socioeconomic status group experiences the lowest survival probability.

Figure 7D. Kaplan-Meier Survival Curves by Stage



Disease stage is clearly associated with survival probabilities. Earlier the stage, the better the survival.

Figure 7E. Kaplan-Meier Survival Curves by Subtype



Hepatocellular carcinoma displayed better survival probabilities than other subtypes of liver cancer for the first six years since diagnosis. The hepatocellular carcinoma survival advantage disappeared afterwards.

Table 4. Hazard Ratios* for the Associations between Death and Sex, Age, Race/Ethnicity, Socioeconomic Status, Disease Stage and Subtype among Invasive Liver Cancer Patients, Los Angeles County, 2000-2017.

	Male		Female		Male and Female	
	HR	95% CI	HR	95% CI	HR	95% CI
Sex						
Male (Reference)					1.00	
Female					0.91	0.87-0.95
Age (years)						
0-39 (Reference)	1.00		1.00		1.00	
40-64	2.72	2.25-3.28	3.06	2.30-4.07	3.40	2.83-4.08
≥65	3.30	2.73-3.98	4.96	3.73-6.58	4.40	3.67-5.28
Race/Ethnicity						
Non-Hispanic White (Reference)	1.00		1.00		1.00	
Non-Hispanic Black	1.01	0.93-1.09	1.20	1.05-1.36	1.05	0.97-1.13
Hispanic	0.90	0.85-0.95	0.89	0.81-0.98	0.90	0.85-0.95
Asian/Pacific Islander	0.76	0.72-0.81	0.75	0.68-0.83	0.74	0.70-0.78
Asian/Pacific Islander Ethnicity						
Chinese	0.71	0.64-0.77	0.70	0.61-0.81	0.67	0.61-0.73
Japanese	0.86	0.71-1.04	0.89	0.72-1.10	0.88	0.75-1.04
Filipino	0.90	0.81-1.01	0.87	0.72-1.04	0.89	0.80-0.99
Korean	0.74	0.67-0.83	0.64	0.54-0.76	0.69	0.62-0.77
Vietnamese	0.67	0.59-0.76	0.74	0.59-0.92	0.65	0.57-0.74
South Asian	0.81	0.59-1.12	0.42	0.22-0.82	0.71	0.52-0.98
Thai/Hmong/Cambodian/Laotian	1.03	0.87-1.22	0.88	0.65-1.21	0.90	0.77-1.07
Hawaiian/Samoan	1.07	0.67-1.70	1.32	0.71-2.47	1.11	0.73-1.70
Socioeconomic Status						
Highest (Reference)	1.00		1.00		1.00	
Upper-Middle	1.11	1.02-1.21	1.15	1.00-1.31	1.10	1.02-1.19
Middle	1.28	1.18-1.39	1.22	1.07-1.40	1.23	1.14-1.33
Lower-Middle	1.30	1.20-1.41	1.30	1.14-1.48	1.28	1.19-1.38
Lowest	1.47	1.36-1.60	1.24	1.09-1.42	1.33	1.23-1.43
Disease stage						
Localized (Reference)	1.00		1.00		1.00	
Regional	1.93	1.83-2.04	1.76	1.61-1.93	1.88	1.79-1.97
Distant	3.44	3.23-3.67	3.12	2.81-3.48	3.33	3.16-3.52
Unknown	2.54	2.37-2.72	2.47	2.24-2.73	2.53	2.39-2.67
Subtype						
Hepatocellular Carcinoma (Reference)	1.00		1.00		1.00	
Non-Hepatocellular Carcinoma	1.17	1.09-1.25	1.17	1.06-1.28	1.16	1.06-1.26

* Hazard ratios obtained from multivariate Cox regression models adjusting for all covariates listed.
HR: Hazard Ratio
CI: Confidence Interval

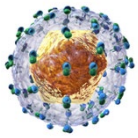
The hazard ratio evaluates increased or decreased probability of dying relative to a reference group while controlling for other factors.

- *Compared to males, female liver cancer patients have a statistically significant 9% lower chance to die;*
- *Compared to those under age 40, patients aged 40-64 are 3.4 times and those aged 65+ are at 4.4 times greater risk of dying.*
- *Relative to Non-Hispanic White, Hispanic and Asian/Pacific Islander liver cancer patients have significantly better chance of survival (10% and 26% respectively);*
- *Relative to the highest socioeconomic status group, liver cancer patients of lowest socioeconomic status have statistically significant 33% higher mortality;*
- *Liver cancer patients who are diagnosed at distant stage have 3.3 times risk of dying as those diagnosed at localized stage;*
- *Hepatocellular carcinoma subtype have 16% lower mortality than the other subtype.*

RISK FACTORS

Cirrhosis

Cirrhosis is the scarring of liver tissue and can be caused by many factors such as viral infections, alcohol consumption, nonalcoholic fatty liver disease, and metabolic syndromes. Regardless of cause, it is the primary risk factor for liver cancer. 1% to 4% of patients with cirrhosis develop liver cancer every year.[1]



Chronic Viral Hepatitis

Chronic viral hepatitis from the hepatitis C virus (HCV) and the hepatitis B virus (HBV) are the first and second leading cause of liver cancer in the US, respectively. People with chronic HCV or HBV are at a 15-20 times greater risk of developing liver cancer when compared to healthy individuals.[2] The latest reported rate for chronic HCV in Los Angeles county was 92 per 100,000 people and 47 per 100,000 people for chronic HBV. Asians and Pacific Islanders regularly account for two-thirds of all annual new chronic hepatitis B cases.[3]

Heavy Alcohol Consumption

Heavy drinking was associated with a linear increase risk of liver cancer after daily intake of alcohol exceeded 60g.[1] Prolonged alcohol abuse can lead to cirrhosis, the primary risk factor for liver cancer.[1] 16%-17% of adults reported binge-drinking in Los Angeles County in the past 30 days. Between 2000 and 2017, the rate of alcoholic related deaths attributed to liver cirrhosis nearly doubled in Los Angeles.[4]

Nonalcoholic Fatty Liver Disease (NAFLD)

NAFLD has the potential to progress to cirrhosis and eventually liver cancer. Studies have reported an annual 2.6% liver cancer incidence rate for those with cirrhosis due to NAFLD.[5] NAFLD may also result in the development of liver cancer in the absence of cirrhosis, possibly due to fibrosis or steatosis. Type 2 diabetes and obesity are risk-factors for NAFLD.[5] Hispanics in California have the highest prevalence of both type 2 diabetes and obesity which may also contribute to them having the highest prevalence of NAFLD.[6,7]

Diabetes

Studies have shown that those with diabetes are 2-2.5 times more likely to develop liver cancer than those without.[8] Insulin resistance is a known risk factor for NAFLD, and therefore can also be considered a risk factor for cirrhosis and liver cancer.[8] In Los Angeles County, the age-adjusted prevalence of diabetes is 7.5%. One-fifth of all adults in Los Angeles aged 60 and over have been diagnosed with diabetes.[9]

Obesity

60% of people in Los Angeles are either overweight or obese.[10] A meta-analysis of cohort studies found that overweight or obese individuals had a 17% and 89% increased risk of liver cancer, respectively. Obesity is also associated with other risk factors linked to liver cancer, such as diabetes and nonalcoholic fatty liver disease.[11]

Aflatoxins

Aflatoxins are carcinogens produced by fungi that can grow on agricultural products, such as rice and peanuts. In studies when aflatoxin metabolites was detected in urine, there was 3.8 fold greater relative risk of developing liver cancer. In subjects where both presence of aflatoxins and the hepatitis B virus was detected, there was a 60-fold increase in relative risk.[3] California has the highest concentration of Asian/Pacific Islanders in the United States, who are disproportionately overrepresented in chronic hepatitis B cases and are also the highest consumers of rice and grains.[12]

Smoking

Smoking cigarettes moderately increases risk of liver cancer. Current smokers are about 50% more likely than those who have never smoked to develop liver cancer. The risk also appears to increase with amount and length of smoking history.[13]

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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 2018 population estimates. Hispanic or Latino individuals account for 48.5% of the County's total population, in contrast to 38.9% in California and 17.8% in the U.S.[1] The proportion of non-Latino whites in Los Angeles County is 26.3%, as compared to 37.5% in California and 61.1% in the U.S.[1] About 8.5% of U.S. Latinos, 8.3% of U.S. Asian Americans, and 4.8% 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 3.2%.[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, 0.1 million Asian Indian and over 93,000 Vietnamese.[1] Los Angeles County is also home to more than 28,000 Native Hawaiians and Other Pacific Islanders.[1]

Among the 4.9 million self-reported Hispanics or Latinos in the County, 76% identify as Mexican, 8.4% Salvadoran, 5.2% Guatemalan, 1.0% Puerto Rican, 0.8% Cuban, 1.0% Honduran, 0.9% Nicaraguan, and 2.8% South American.[1]

About 3.5 million Los Angeles County residents are foreign-born; 14.7% of them entered the country since 2010.[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 53,000 individuals of Arabic descent live in Los Angeles County.[1]

Every numerically important religious group in the U.S. is represented by sizable 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 cancer occurrence and conducting epidemiological investigations.

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 regional registry within six months after the patient's diagnosis or treatment. Pathologists diagnosing cancer are required to submit an electronic copy of the pathology report within two weeks of diagnosis. Each hospital or other reporting facility is required 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 to the pathology reports 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 CANCER TRENDS

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. Confidentiality of computerized data is assured by highly restricted access and protected by encryption. 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 California Protection of Human Subjects Board. For studies from outside investigators, review and approval by a federally approved institutional review board is required.

CANCER DATA

Cancer data used in this report are based on new cancer cases diagnosed among the residents in Los Angeles County from January 1, 2000 to December 31, 2017.

Cancer patients are grouped by sex (male, female), age (0-39, 40-49, 50-64, 65+ years old), race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, Asian/Pacific Islander), socioeconomic status (SES) (high, mid-high, middle, mid-low, low), and stage of disease at diagnosis (localized, regional, distant). Asian/Pacific Islanders are further categorized as Chinese, Japanese, Filipino, Korean, Vietnamese, South Asian that includes Indian, Pakistani, Sri Lankan, Nepalese, Bhutanese, and Sikkimese, and Thai/Hmong/Cambodian/Laotian. Localized stage refers to cancer that has not spread from original location. Regional stage refers to cancer that has spread beyond original location to either nearby organs/lymph nodes, and distant stage refers to cancer that has spread to other parts of the body.

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.

STATISTICAL METHODS

We provide case count and percentage distribution of cancer cases by patient demographics and tumor stage at diagnosis. In order to compare cancer risk levels among different groups, we calculate and present the age-adjusted incidence rates and age-adjusted mortality rates by considering the number of cancer occurrences and cancer related deaths, respectively, in relation to the size of the group's at-risk population. In order to preserve statistical stability of rate estimation and comply with the suppression rules set by the California Cancer Registry (CCR), minimum case count of less than event threshold for numerator is set at 11 is not shown in tables and not used for calculating rates. Annual population estimates for 2000-2017 in Los Angeles County by aggregated racial/ethnic groups were provided by the CCR based on the county level estimates by the National Center for Health Statistics. We estimated the annual populations for Asian and Pacific Islander ethnic groups as identified in the 2000 and 2010 population censuses as well as the 2011-2015 American Community Survey 5-year Estimates using linear interpolation and extrapolation. South Asian population included Asian Indians, Pakistanis, Sri Lankans, Bangladeshis, and Nepalese. Because Bhutanese and Sikkimese, two small population groups, are included in the incidence data but not in the population data, rate estimates for South Asians may be overestimated slightly.

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. Relative survival estimates the probability of survival from cancer after considering the chances of dying from other causes. It is calculated as a ratio of the observed survival among cancer patients to the expected survival from all causes of death using survival probabilities in the general population of same age group. Using non-parametric Kaplan-Meier survival function, we calculated the observed survival at 5-years 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 over time and differs by patient and tumor characteristics. We also estimated hazard ratio by comparing the probability of deaths between age groups, race/ethnicity groups, SES and stage using multivariate Cox regression model.

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.

CAUTIONS IN INTERPRETATION

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.

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