Survival of Pediatric Cancer Patients

By Teresa Cameron

Pediatric Cancer Overview

Cancer is the 2nd commonest cause of death in children in the developed countries.

15,780

Estimated children are diagnosed with cancer in the U.S. each year

38,000

Childhood malignant cancer deaths were averted in the U.S. from 1975 to 2006 as a result of more effective treatments

50%

Decrease in all malignant childhood cancers mortality rates between 1975 and 2006

SEER Program

The SEER (Surveillance, Epidemiology, and End Results) Program began in 1973 and provides information on cancer statistics to help reduce the cancer burden among the U.S. population.

SEER collects and publishes cancer incidence and survival data from population-based registries covering approximately 48% of the U.S. population.

263 variables

Including patient demographics, tumor morphology, extent of disease, treatments, and survival data.

Geographic Information Systems

Portal with interactive mapping and visualization of cancer-related geospatial data

Cancer Statistics Review (CSR)

Annual report of most recent cancer incidence, mortality, survival, prevalence, and lifetime risk statistics

Pediatric Cancer Data

Patients

69,263

0 – 17 year old

Years

2000 - 2018

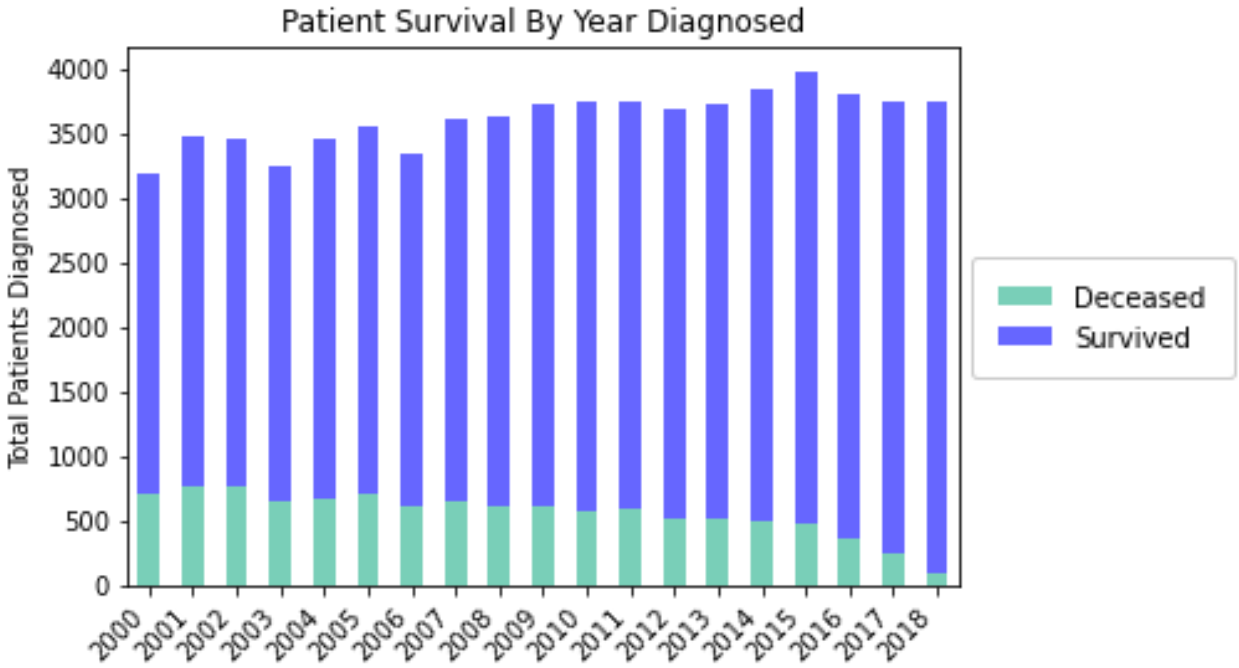
Variables

8

Age, Gender, Year Diagnosed, Race, Site, Median Household Income, Rural-Urban Code, Survival Months, Cause of Death

Patient Survival by Year

Bar Graph

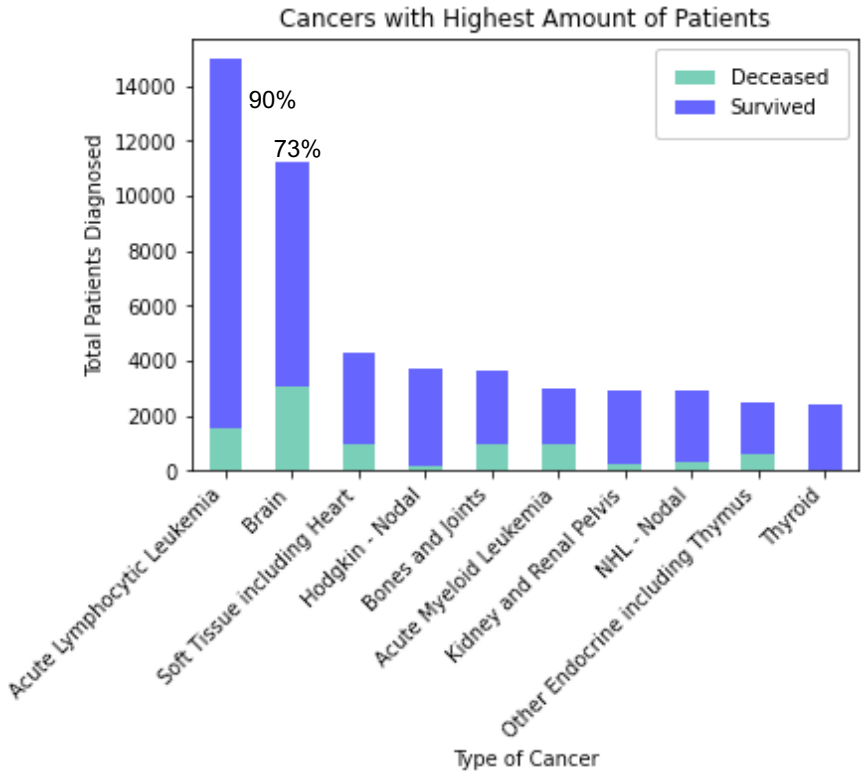


Table

	Deceased	Survived
2000	22.26%	77.74%
2001	21.90%	78.10%
2002	22.35%	77.65%
2003	20.03%	79.97%
2004	19.16%	80.84%
2005	20.10%	79.90%
2006	18.07%	81.93%
2007	18.07%	81.93%
2008	17.14%	82.86%
2009	16.33%	83.67%
2010	15.19%	84.81%
2011	15.74%	84.26%
2012	14.10%	85.90%
2013	14.14%	85.86%
2014	12.90%	87.10%
2015	11.86%	88.14%
2016	9.74%	90.26%
2017	6.61%	93.39%
2018	2.80%	97.20%

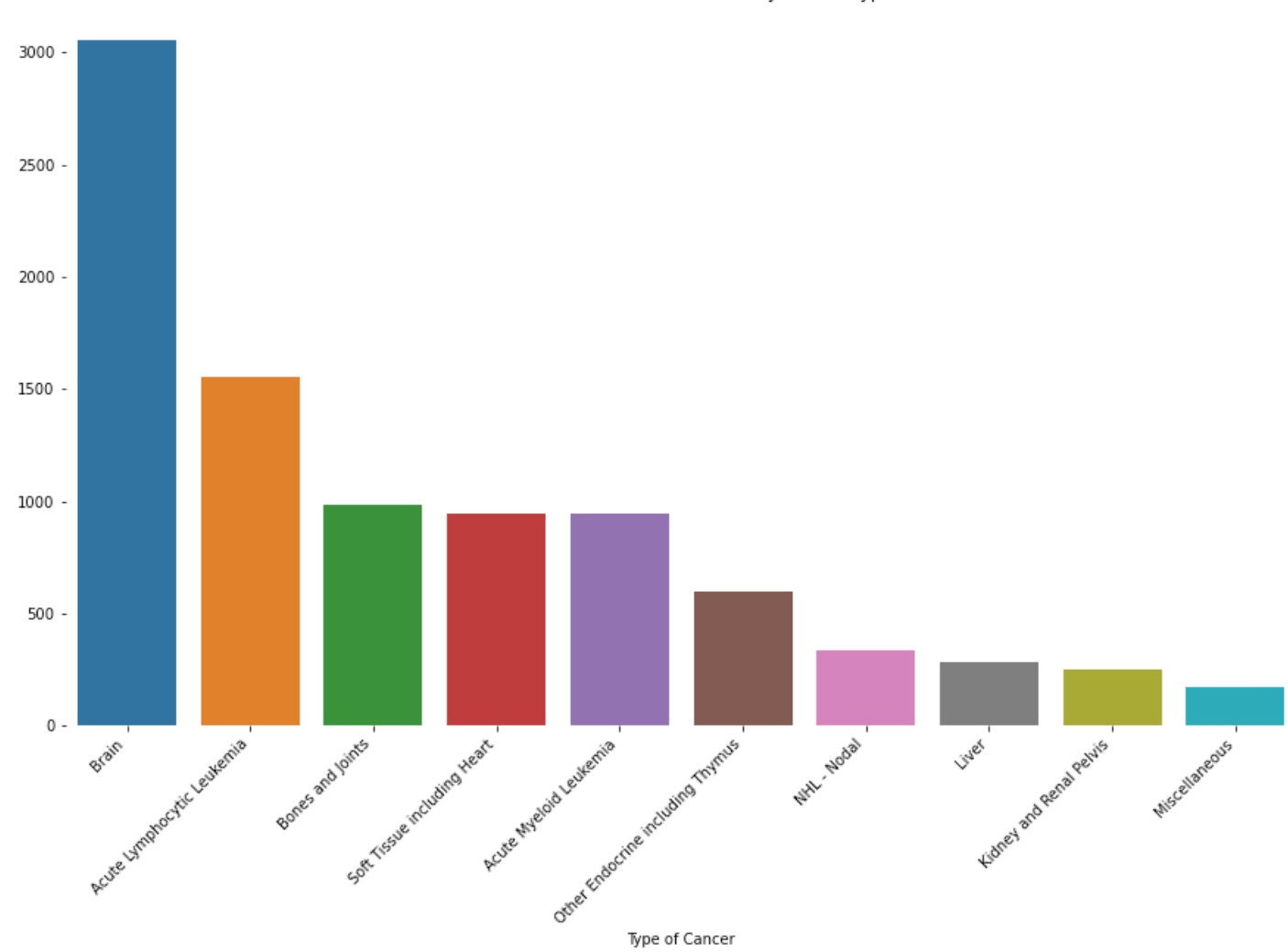
Patient Survival by Cancer Type

Bar Graph

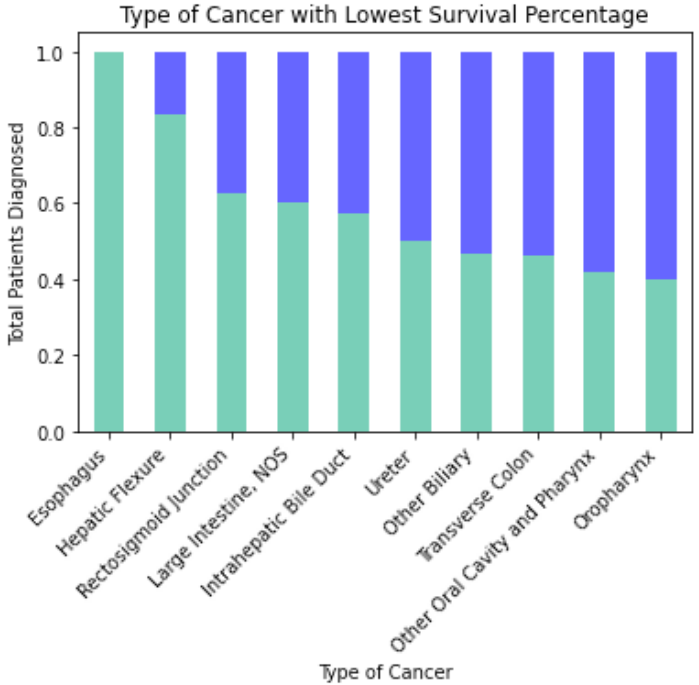


Table

	Deceased	Survived
Acute Lymphocytic Leukemia	1556	13406
Brain	3051	8205
Soft Tissue including Heart	945	3331
Hodgkin - Nodal	131	3544
Bones and Joints	987	2613
Acute Myeloid Leukemia	942	2050
Kidney and Renal Pelvis	250	2671
NHL - Nodal	336	2573
Other Endocrine including Thymus	600	[illegible]52
Thyroid	14	2[illegible]4


Total Deaths from 2000 to 2018 by Cancer Type
3000
2500
2000
1500
1000
500
0
Brain
Acute Lymphocytic Leukemia
Bones and Joints
Soft Tissue including Heart
Acute Myeloid Leukemia
Other Endocrine including Thymus
NHL - Nodal
Liver
Kidney and Renal Pelvis
Miscellaneous
Type of Cancer

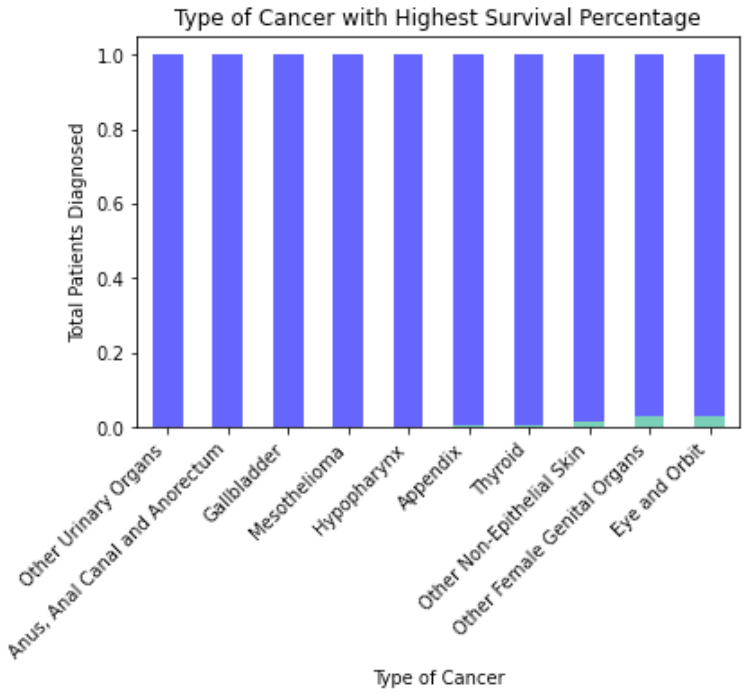
Bar Graph



Table

	Deceased	Survived
Esophagus	100.00%	0.00%
Hepatic Flexure	83.33%	16.67%
Rectosigmoid Junction	62.50%	37.50%
Large Intestine, NOS	60.00%	40.00%
Intrahepatic Bile Duct	57.14%	42.86%
Ureter	50.00%	50.00%
Other Biliary	46.67%	53.33%
Transverse Colon	46.15%	53.85%
Other Oral Cavity and Pharynx	41.67%	58[illegible]%
Oropharynx	40.00%	60.00%

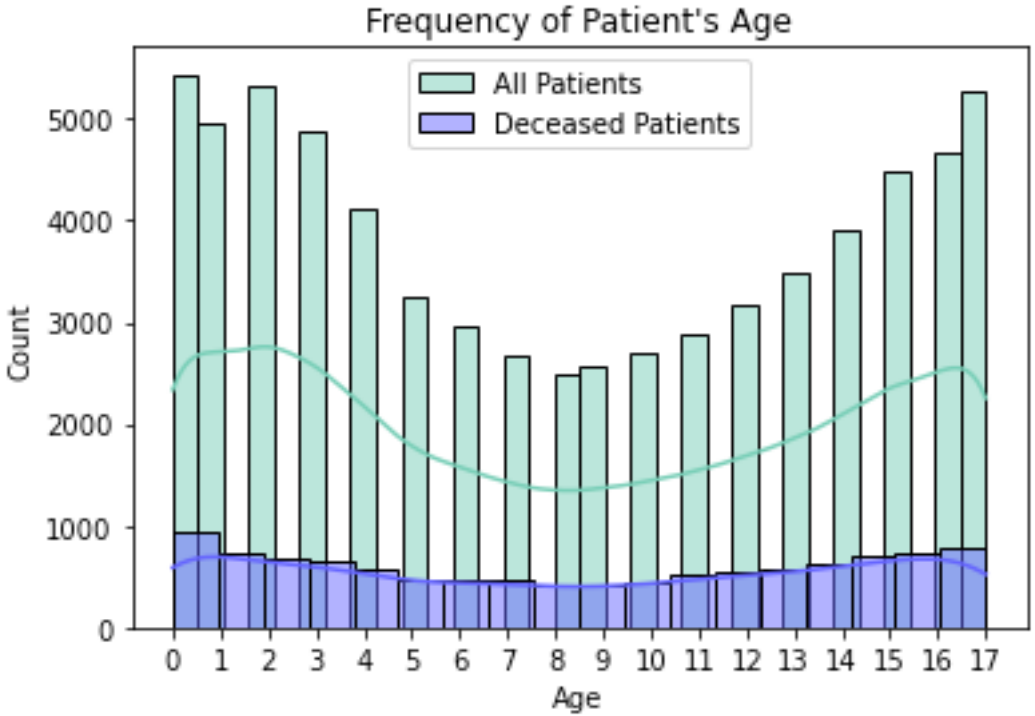
Bar Graph



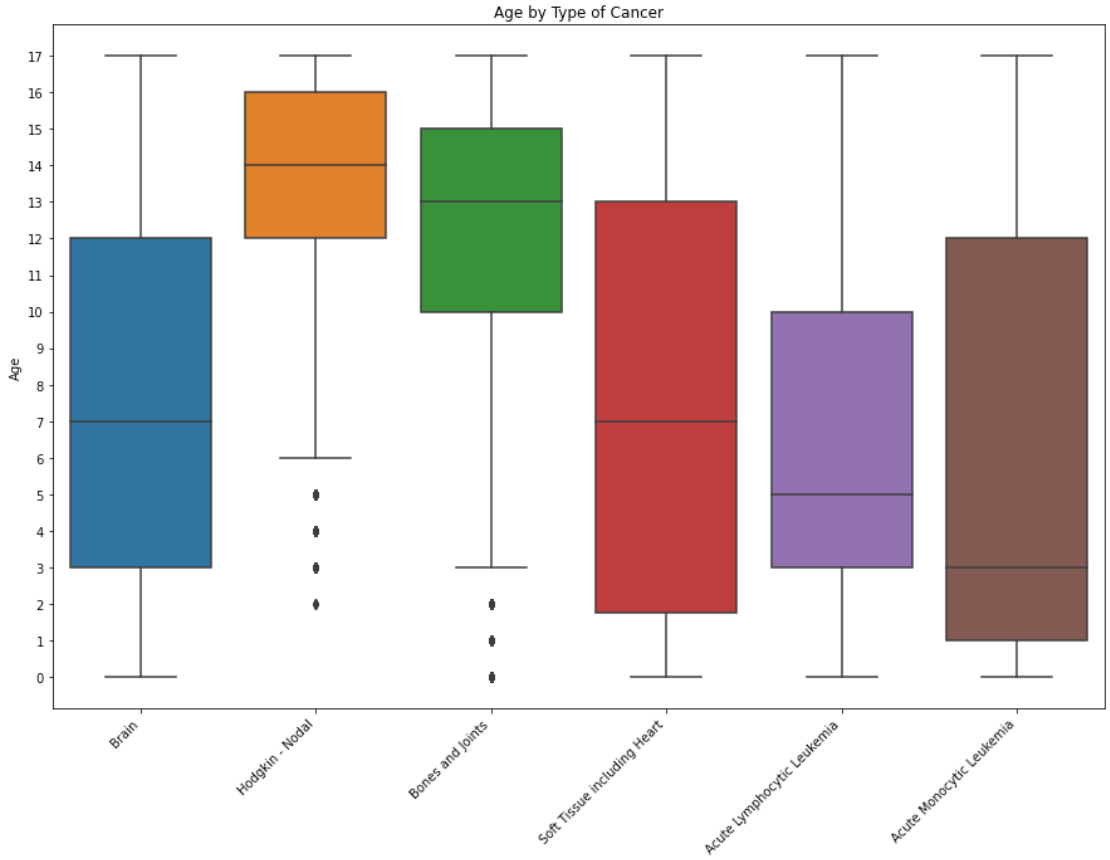
Table

	Deceased	Survived
Other Urinary Organs	0.00%	100.00%
Anus, Anal Canal and Anorectum	0.00%	100.00%
Gallbladder	0.00%	100.00%
Mesothelioma	0.00%	100.00%
Hypopharynx	0.00%	100.00%
Appendix	0.43%	99.57%
Thyroid	0.59%	99.41%
Other Non-Epithelial Skin	1.43%	98.57%
Other Female Genital Organs	2.86%	97.1
Eye and Orbit	2.97%	97.03%

Distribution of Patient's Age

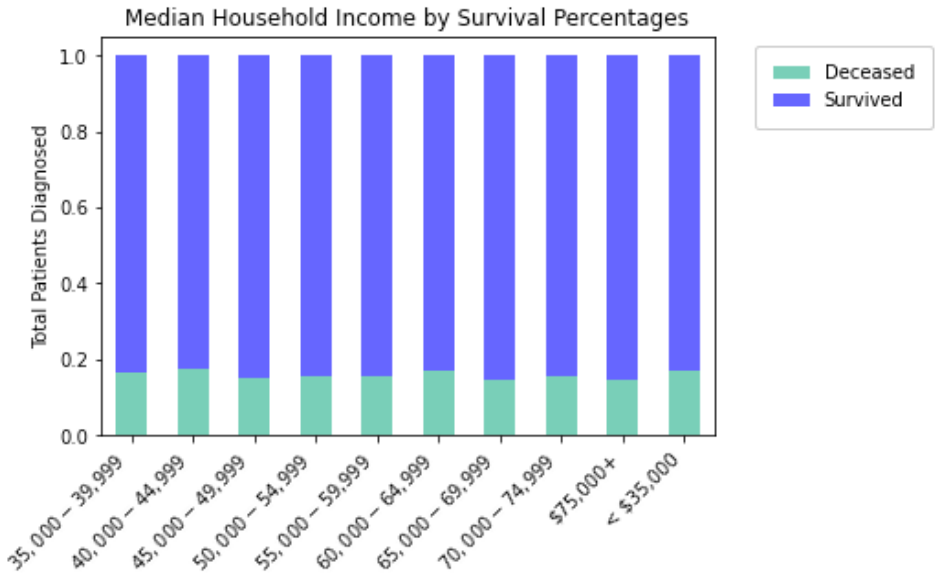


Distribution of Patient's Age by Type of Cancer



Patient Survival by County's Median Household Income

Bar Graph

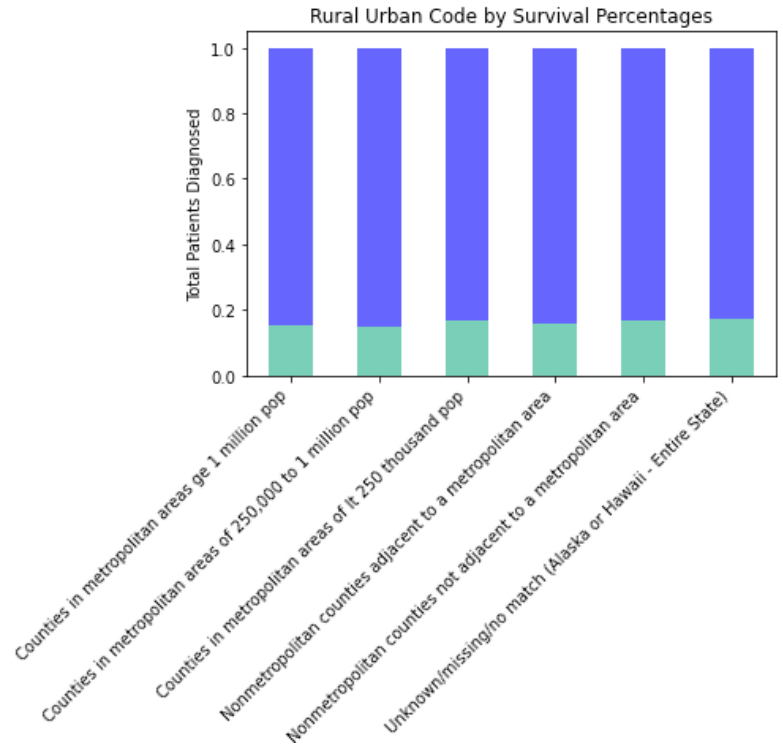


Table

	Deceased	Survived
35, 000– **39,999**	16.74%	83.26%
40, 000– **44,999**	17.40%	82.60%
45, 000– **49,999**	15.05%	84.95%
50, 000– **54,999**	15.71%	84.29%
55, 000– **59,999**	15.30%	84.70%
60, 000– **64,999**	17.20%	82.80%
65, 000– **69,999**	14.64%	85.36%
70, 000– **74,999**	15.63%	84.37%
$75,000+	14.66%	85.34%
< $35,000	16.95%	83.05%

Patient Survival by County's Population

Bar Graph

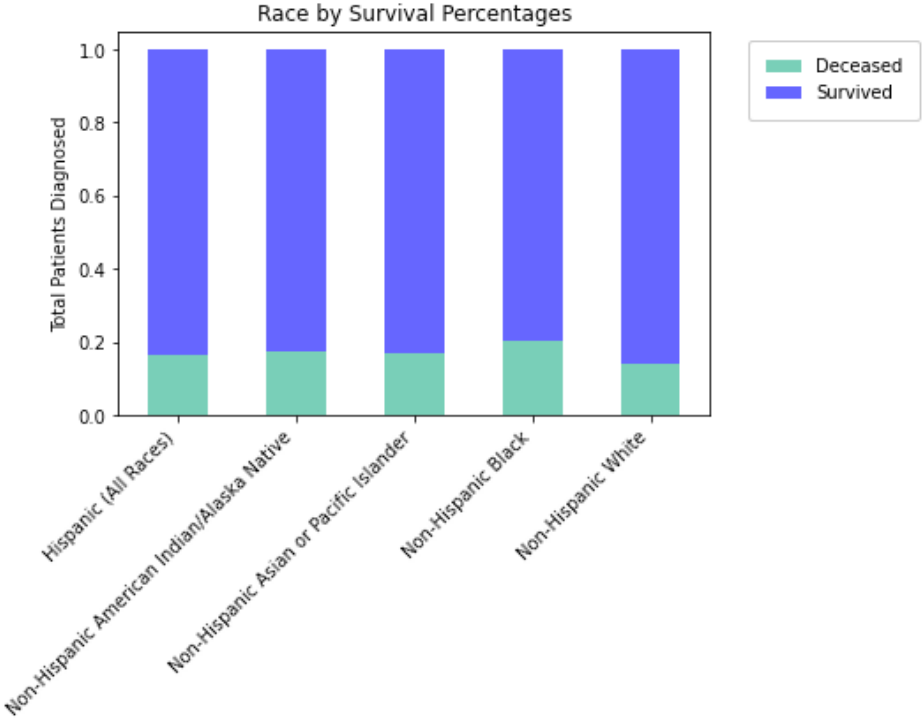


Table

	Deceased	Survived
Counties in metropolitan areas ge 1 million pop	15.46%	84.54%
Counties in metropolitan areas of 250,000 to 1 million pop	14.99%	85.01%
Counties in metropolitan areas of lt 250 thousand pop	16.64%	83.36%
Nonmetropolitan counties adjacent to a metropolitan area	15.77%	84.23%
Nonmetropolitan counties not adjacent to a metropolitan area	16.62%	83.38%
Unknown/missing/no match (Alaska or Hawaii - Entire State)	17.07%	82.93%

Patient Survival by Race

Bar Graph



Table

	Deceased	Survived
Hispanic (All Races)	16.48%	83.52%
Non-Hispanic American Indian/Alaska Native	17.44%	82.56%
Non-Hispanic Asian or Pacific Islander	16.89%	83.11%
Non-Hispanic Black	20.45%	79.55%
Non-Hispanic White	13.90%	86.10%

Z-Test to Determine Statistical Significance

01

Sample

Select a sample of data for each race variable.

Null Hypothesis: **The race of patients does not have an effect on survival rate.**

Alternative Hypothesis: **The race of patients affected their survival rate.**

02

Normal Distribution

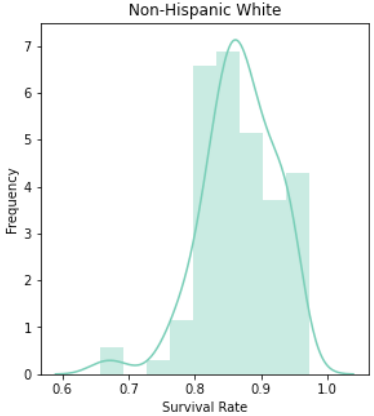
Check the samples are approximately normally distributed.

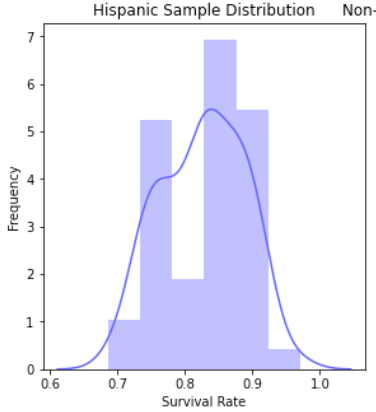
03

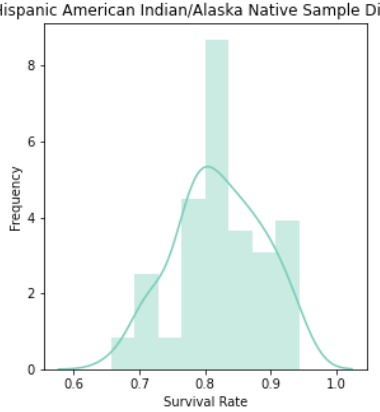
Z-score and P-value

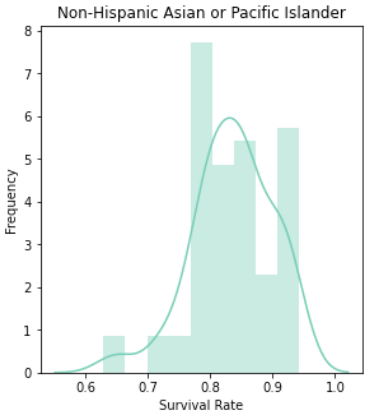
Compares the means of each sample to each other.

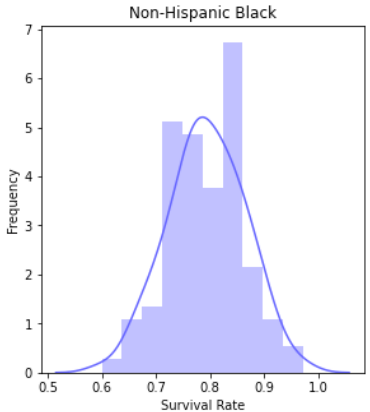
Distribution of Survival Rate from Sample











Means of Samples

87% Non-Hispanic White
83% Hispanic
82% American Indian/Alaska Native

Means of Samples

84% Asian or Pacific Islander
79% Non-Hispanic Black

Z-Score and P-Value

01

Z-Score

Measures how many standard deviations a value is from the mean.

02

P-Value 0.05

Probability that the measured effect is due to randomness.

Non-Hispanic Black

Z-Score : 8.08
P-Value: 6.40e-16

Hispanic

Z-Score : 4.79
P-Value: 1.65e-06

American Indian Alaskan Native

Z-Score: 5.21
P-Value: 1.89e-07

Asian and Pacific Islander

Z-Score : 3.53
P-Value: 0.00041

We can reject the null hypothesis and accept the alternative hypothesis that the race of patients affected their survival rate.

What Does This Mean?

The conclusion is that the means from the random sample proves a significant correlation between race of patient and survival rate. We still cannot establish causation between these features, and this also does not indicate a correlation in the population.

Next steps for this analysis would be to examine additional variables such as treatment or types of cancers to see if we can find other variables that could contribute to this disparity.

Thank you!