Identifying Determinants of Disparities in Lung Cancer Survival Rates from Electronic Health Record Data

Wanting Cui, Joseph Finkelstein
Icahn School of Medicine at Mount Sinai, New York, NY, USA

Introduction

- Lung cancer is one of the most common cancer in the United States for both males and females.
- Incidence and mortality rates are higher among Blacks as compared to Whites with lung cancer.
- The major drivers of disparity in lung cancer survival include screening adherence, access to care and hereditary factors.
- The goal of this pilot study was to identify major drivers that affect disparities in lung cancer survival using data from electronic health records

Method

Dataset

- A de-identified dataset was generated from Epic Electronic Health Record system at the Mount Sinai Health System in New York City that include lung cancer patients.
- Time period: Jan 2003 – Nov 2020
- We identified two subsets of patients:
    - Short Term Survival: Patients deceased within one year of cancer diagnosis
    - Long Term Survival: Patients survived over 5 years after cancer diagnosis

Logistic Regression

- Logistic regression was performed to investigate the effect of demographical and cancer factors on patients' duration of survival after cancer diagnosis.
- The independent variables are age, sex, race, cancer stage and genetic testing
- The dependent variable was defined as whether a patient survived a short time
    - Short Term Survival: 1
    - Long Term Survival: 0

Gene Mutation

- Identify genetic variants that affect the survival of these lung cancer patients and analyzed variants distribution by race groups

Results

Summary statistics

- Total number of patients: 1099
- Short Term Survival: 349
- Long Term Survival: 750

Table 1. Summary statistics o f short term and long term survival patients.

	Short Term Survival (n = 349)		Long Term Survival (n = 750)	
Age at Diagnosis				
mean	68.42		mean	66.55
std	11.07		std	10.57
Gender				
Female	147	42.1%	446	59.5%
Male	202	57.9%	304	40.5%
Race				
Black or African American	90	25.8%	93	12.4%
Other	88	25.2%	162	21.6%
White	171	49.0%	495	66.0%
Stage				
stage1	11	3.2%	385	51.3%
stage2	16	4.6%	61	8.1%
stage3	78	22.3%	147	19.6%
stage4	244	69.9%	157	20.9%

Results

Logistic Regression

- Gender, race and cancer stage were important factors
- Patients who were diagnosed at early stages of lung cancer were more likely to survive over 5 years than those who were diagnosed at advanced stages of lung cancer
- Black patients and male patients had higher odds of being deceased in a shorter period of time after diagnoses

Table 2. Logistic regression results.

	OR	CI (2.50%)	CI (97.50%)	P-Value
Age group: Young adult	1			
Age group: Middle age adult	1.92	0.45	8.15	0.374
Age group: Older adult	3.73	0.88	15.82	0.074
Gender: Female	1.00			
Gender: Male	1.92	1.40	2.62	0
Race: White	1.00			
Race: Black	1.82	1.22	2.73	0.003
Race: Other	1.59	1.03	2.46	0.036
Stage1	1.00			
Stage2	9.05	3.97	20.63	0
Stage3	18.87	9.65	36.91	0
Stage4	52.14	27.45	99.03	0
Genetic test: No	1.00			
Genetic test: Yes	1.34	0.95	1.88	0.093

Gene Mutation

- 214 patients had somatic genetic testing results.
- KRAS was the most common mutation.
- Patients who survived a shorter time have a higher proportion of TP53 gene mutations.
- There was higher proportion of Black patients than White patients with TP53 gene mutations who survived a shorter time

Table 3. Summary of somatic mutations by survival and race.

Short Term Survival					Long Term Survival			
Race	Gene	Count	Percent		Race	Gene	Count	Percent
Black	TP53	9	52.90%		Black	EGFR	4	50.00%
(n= 17)	KRAS	6	35.30%		(n = 8)	KRAS	3	37.50%
	EGFR	2	11.80%			TP53	1	12.50%
White	KRAS	20	55.60%		White	KRAS	51	60.70%
(n = 36)	TP53	10	27.80%		(n = 84)	EGFR	23	27.40%
	EGFR	3	8.30%			TP53	14	16.70%

Conclusion

- Gender, race, cancer stage and somatic mutations were important factors that affects the length of survival of lung cancer patients after diagnoses.
- Male and Black and Hispanic patients who were diagnosed in later cancer stages were the people most susceptible to shorter length of survival after cancer diagnosis
- KRAS was the most common genetic mutation among lung cancer patients
- Patients with TP53 mutations were at higher odds of being deceased in less than a year after cancer diagnoses
- Black patients had a higher proportion of the TP53 mutations

References

[1] Coughlin SS, Matthews-Juarez P, Juarez PD, Melton CE, King M. Opportunities to address lung cancer disparities among African Americans. Cancer Med. 2014 Dec;3(6):1467-76.

[2] Japuntich SJ, Krieger NH, Salvas AL, Carey MP. Racial Disparities in Lung Cancer Screening: An Exploratory Investigation. J Natl Med Assoc. 2018 Oct;110(5):424-427.