

Epidemiological trends and survival outcomes of synchronous brain metastases from 2015 to 2019: a population-based study

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BACKGROUND

- Brain metastases occur in 10-20% of adults with malignancies.¹
- Synchronous brain metastases (sBM) = brain metastases identified at the time of primary cancer diagnosis
- Previous studies reporting epidemiological trends in sBM using data from 2000-2015.^{2,3}
- sBM shown to reduce survival
- Updated studies are necessary to inform surveillance and diagnostic strategies, resource allocation, and the initiation of preventive measures.

STUDY OBJECTIVE

Describe the incidence, demographics, and prognosis of patients with sBM in the United States from 2015-2019.

METHODS

- Study Design:** Retrospective population-based study
- Data Collection:** Clinical, demographic, and survival data were collected from the NCI Surveillance, Epidemiology, and End Results Program (SEER) 17 Registries database.
- Inclusion Criteria:**
 - Malignant cancers
 - Dx between 01/01/15 – 12/31/19
- Exclusion Criteria:**
 - Benign tumors
 - Unknown status of sBM
 - Dx by autopsy/death certificate
- Main outcomes:** Incidence of sBM and overall survival
- Statistical Analysis:**
 - The NCI SEER*Stat version 8.4.0 was used to calculate incidence rates age-adjusted to the 2000 US population
 - SPSS used for additional analysis.
 - Survival Analysis = Kaplan Meier method and multivariate Cox regression

RESULTS

TABLE 1. Population Characteristics (N = 1,872,057)

Characteristic	Total
Age - Median (IQR)	65 (55-70)
Female Sex – No. (%)	947,727 (50.6%)
Race – No. (%)	
White	1,490,015 (79.6%)
Black	191,795 (10.2%)
Asian or Pacific Islander	144,073 (7.7%)
American Indian/Alaska Native	12,612 (0.1%)
Hispanic – No. (%)	225,956 (12.1%)
Metastases at Diagnosis	
sBM	35,986 (1.9%)
Extracranial Mets Only	259,001 (13.8%)
None	1,577,070 (84.2%)

TABLE 2. Trends in sBM by Primary Site from 2015-2019

Primary Tumor Site	Incidence Rate (per 100,000 persons)	AAPC (%)	P-value
All Sites	7.1	-0.7	0.519
Lung and Bronchus	5.40	-1.8	0.164
Melanoma	0.31	3.5	0.058
Breast	0.28	1.4	0.666
Kidney and Renal Pelvis	0.22	-0.3	0.804
Colorectal	0.11	5.7	0.028
Esophagus	0.07	-1.1	0.799
Pancreas	0.05	3.4	0.822
Prostate	0.05	6.3	0.135

AAPC = Average Annual Percent Change

Primary tumors associated with sBM varied by age and sex.

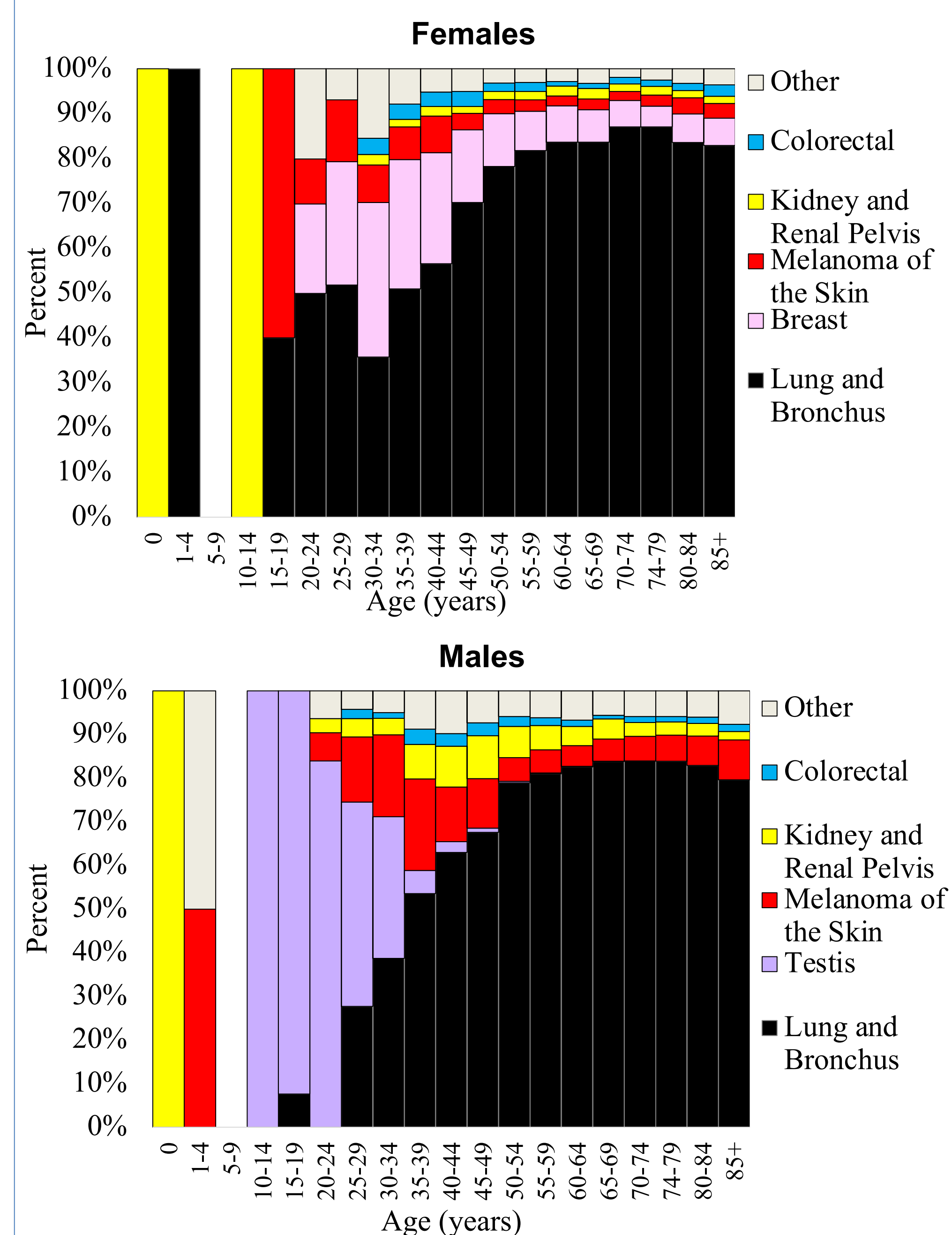
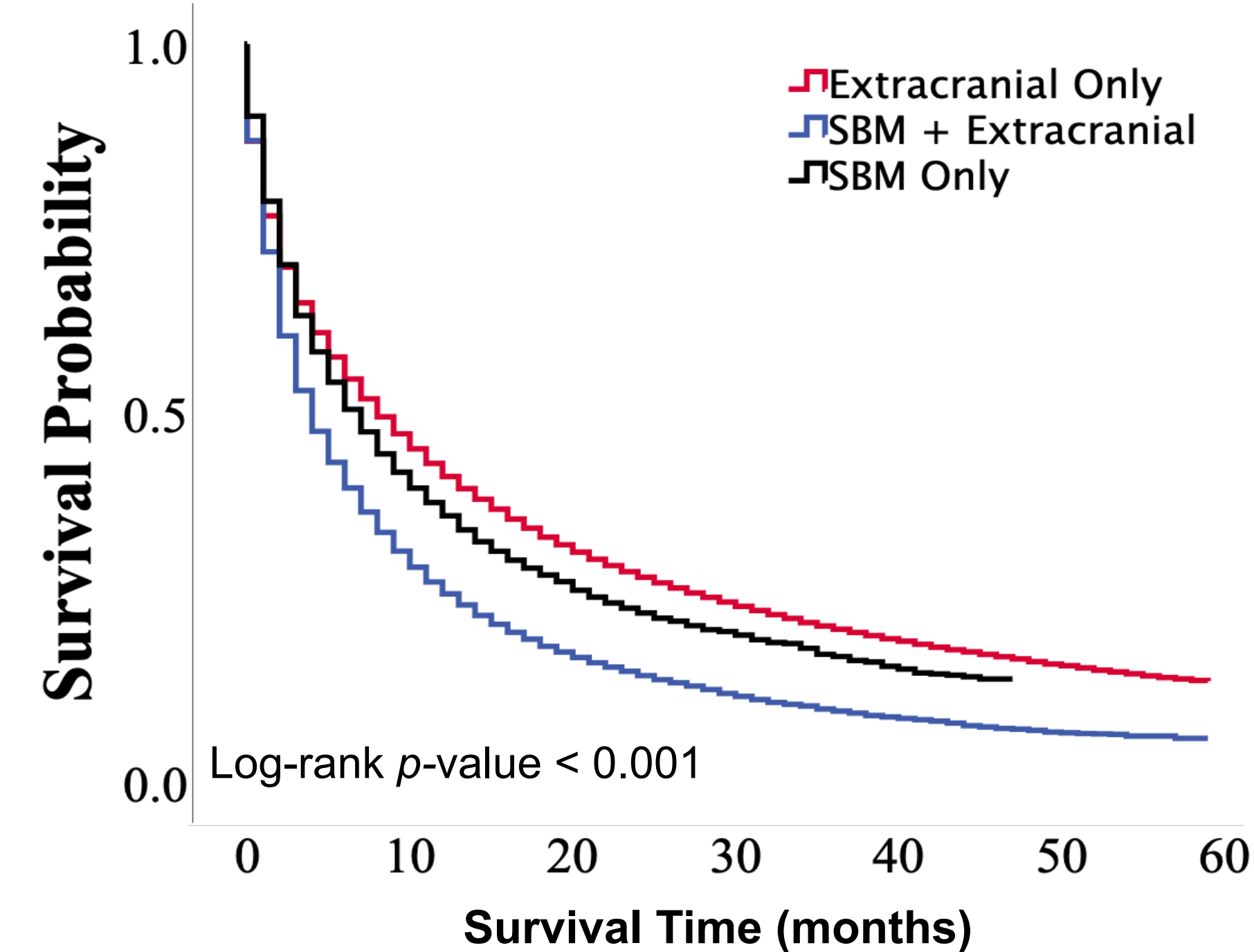


Figure 1. Frequency of sBM by primary site and age in females and males from SEER 2015-2019. Other primary sites in females include pancreas, ovary, stomach, liver, thyroid, esophagus, and bladder. Other primary sites in females include pancreas, prostate, breast, stomach, liver, thyroid, esophagus, and bladder.

Survival of Patients with sBM Only, sBM with Synchronous Extracranial Metastases, and Synchronous Extracranial Metastases Alone



Synchronous Metastases	Median Survival Time [95% CI] (months)	Hazard Ratio [95% CI]	P value
sBM Only	7.00 [6.68-7.32]	1 [Ref]	
sBM + Extracranial	4.00 [3.89 – 4.11]	1.36 [1.32-1.40]	<0.001
Extracranial Only	8.00 [7.92-8.08]	0.88 [0.86-0.91]	<0.001

Figure 2. Kaplan-Meier survival curves and survival differences in patients with sBM only, sBM and synchronous extracranial metastases, and synchronous extracranial metastases only. A Cox Regression model was used to estimate hazard ratios. Sex, age at diagnosis, race, and year of diagnosis were used as covariates.

CONCLUSIONS

- The incidence of sBM was stable from 2015-2019.
- sBM were most commonly associated with lung and bronchus cancers.
- Median survival of patients with sBM = 5 months
- Overall survival was reduced in patients with sBM relative to patients with synchronous extracranial metastases only.

LIMITATIONS

- We could not control for several variables that impact the survival of patients with BM (tumor volume, screening method, antineoplastic therapy used, healthcare type).

IMPLICATIONS

- Because of the generalizability of the SEER program, which encompasses roughly 27% of the US population, our results have potential applications for screening and diagnostic protocols for sBM in patients with malignant disease.
- Future direction: Build multi-institutional databases to study the BM identified after diagnosis of primary cancer.

ACKNOWLEDGEMENTS

The data acquisition of the project was supported by NCI. Jordina Rincon-Torroella, MD is an NINDS R25 training grant awardee (5R25NS065729). Thank you to Dr. Kelly Gebo and the Scholarly Concentrations Program. This project was supported by the Dean's Summer Research funding.

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