

# Cancer Survival Analysis: The Role of Age, Sex, and Socioeconomic

To this day, cancer is one of the leading causes of death and in spite of decades of trials and research, we are yet to crack the full picture. Leading doctors and scientists are looking for patterns in different aspects of life, hoping to find something that has a positive - or negative - effect on beating cancer. In this report we explore and study research that explain the relationship amongst age, biological sex, and the patient's economic background. We see datasets from cancer registries and focus on how these variables influence the outcome. Our goal is to summarize three peer-reviewed papers in regards to our mission, and see what wisdom they offer.

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## Age-related differences in cancer relative survival in the United States: a SEER-18 analysis

DOI: 10.1002/ijc.34463

Withrow et al., International Journal of Cancer, 2023

Globally, cancer survival has improved since the 1990s, however older adults haven't seen the same progress. For example, In 2017 in the United States alone, about half a million people aged 75+ were dealing with cancer, and this number only goes higher as the entire population ages. This study's mission is to try to understand why older adults, despite living in an age of medical advancements, still show worse survival rates compared to younger patients. This is done by exploring the 10 main cancer sites which will be delved into later.

To find the answer, the 1-year relative survival for 10 major cancer types is used, which covers over 60% of cancer deaths. The RS values were calculated using the Ederer II method. The dataset comes from the SEER-18 cancer registries of people over 50 years, focusing on prostate, breast, colon, ovary, esophagus, stomach, liver, lung, and pancreas. Patients were grouped by their cancer stage (localized, regional, distant) and age (50 - 64, 65 - 74, 75 - 84, and 85 - 99. People aged 100+ were excluded).

Data analysts show that the type of cancer, the stage it is in, and the patient's age all affect the 1-year survival rate changes. Prostate and breast cancers had the highest RS ,above 80%, while pancreatic had the lowest, under 25%. Survival declines with age, especially for cases that were diagnosed too late, though some (like liver cancer) show little change. Most of the deaths happened within the first year, showing the importance of early detection. Once that year is surpassed, the age-related gaps shrink. In short, older adults struggle more to survive the first year. The authors recommend better early diagnostics and wider access to treatment as key steps forward.

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## **Sex differences in cancer incidence and survival: a pan-cancer analysis**

DOI: 10.1158/1055-9965.EPI-20-0036  
Dong et al., Cancer Epidemiology, Biomarkers & Prevention, 2020

While often overlooked in treatment decisions, a patient's sex does play a critical role in how likely they are to get cancer and how well they survive it. Research shows men tend to develop cancer more often and survive it less than women, but the reasons are yet to be determined. The authors aim to explore these differences by deducing cancer incidences and survival across sexes. Understanding how sex impacts cancer outcomes could lead to more effective treatments for all patients.

In this study, two sources were used to gather a huge amount of cancer data to find how sex affects cancer. These datasets are from NPCR and the SEER program, covering almost the entire U.S. population. For survival data specifically, the SEER program was used which represents about 28% of the country. Overall 11.4 million malignant incidents and 2.9 million survival cases were studied. Sex-specific cancers like prostate or ovary were left out. Patients were grouped by age, race, their sex. Models such as IRR (incidence rate ratio) and Cox proportional hazards were used to compare and analyze cancer risk and survival between the aforementioned groups.

In the end, the research found that males catch cancer more often and have worse survival chances than females among different cancer sites. Especially for cancers like Kaposi sarcoma, liver cancer, and mesothelioma, men had worse outcomes. Things like smoking, dangerous jobs, and less doctor visits may explain some of the differences. Data also shows that among younger adults, women actually had more cancer than men, possibly because of things like indoor/outdoor tanning. Men with breast or thyroid cancer had worse survival, probably because of late diagnosis. These results show that both body differences and behavior matter. The findings tell the tale that biology and lifestyle both affect cancer survival, and treatments for them should be tailored to men and women separately.

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## **Effects of socioeconomic status on cancer patient survival: counterfactual event-based mediation analysis**

DOI: 10.1007/s10552-020-01361-6  
Lin et al., Cancer Causes Control, 2021

This study explores how things like income, education, and social class impact how long patients survive after confronting cancer. It's still unclear whether the effect of socioeconomic status (SES) is direct or indirect. While it's known that people with lower SES often face more barriers to care, the extent of that impact isn't fully understood. By understanding the impact, healthcare policies can be adjusted to better meet the needs of disadvantaged groups

Data from the SEER registry was used, covering lung, liver, colorectal, and stomach cancer cases between 2011 and 2014. Containing over 350,000 patients, its key variables included cancer stage, age, gender, race, and the patients SES level. Kaplan-Meier plots were utilized to estimate survival rate and Cox regression models were made to analyze mediation effects.

The study found that most of the SES impact did not come from the stage the cancer is in. For example in lung cancer, only 12% of the survival was due to the stage; the rest came from other factors like

inaccessible treatments or overall bad health. Patients with higher income and SES tend to live longer, especially if their cancer is diagnosed at an earlier stage. On the other hand, low-income patients are more likely to be diagnosed late, which lowers their chance of survival. The paper suggests that improving early diagnosis for poorer patients could help reduce cancer deaths.

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## Sources

### **Age-related differences in cancer relative survival in the United States: a SEER-18 analysis**

<https://pubmed.ncbi.nlm.nih.gov/36752633/>

### **Sex differences in cancer incidence and survival: a pan-cancer analysis**

<https://pubmed.ncbi.nlm.nih.gov/32349967/>

### **Effects of socioeconomic status on cancer patient survival: counterfactual event-based mediation analysis**

<https://pubmed.ncbi.nlm.nih.gov/33211220/>