Cancer Survival as a Function of Age at Diagnosis: A Study of the Surveillance, Epidemiology and End Results Database

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Abstract

Background: Recent research suggested that cancer survival has improved in recent cohorts. Improvement in cancer survival is considered a valuable tool introduced to the treatment of cancers. The aim of this study is to investigate the changes in the survival profile across patients with the most incident cancers. Methods: Survival data of 3.94 million patients diagnosed with 23 primary-site cancers within the periods of 1973 to 1983, 1983 to 1993, and 1993 to 2003 were extracted from the Surveillance, Epidemiology and End Results Database. Gender and cause-specific survival probabilities were estimated at five-year time-points, and differences with age-specific factors which manipulate the survival of these plots. II. For most of the figures of the studied cancers, there is a definite shift of cancer survival from the left to the right from the earlier to the later cohorts. This denotes a considerable improvement in survival of these cancers at the youngest ages, with the greatest survival improvements in non-Hodgkin lymphoma and leukemia. Exceptions are brain, lung, and prostate cancers. Live cancer gets worse in the latest decade. (Fig. 1)

Methods

- SEER*stat software (version 6.5.2) was used to download and analyze patients’ cause-specific survival.
- The cause-specific survival presented in this study is an estimate of the survival of patients with a particular cancer, not from primary cancer only, not from a secondary cancer or other associated causes.
- The KM estimator calculates the survival probability at a defined period of time based on calculation of the survival estimate at the end of each month of this period. This method allows for early exclusion of those who deceased during the specified time interval and for prompt censoring of the cases born from follow-up, with regular adjustment of the at-risk group (denominator) on a monthly basis, in order to introduce an accurate net survival estimate for the defined period of time.
- One, three, and five-year survival data for approximately 3.54 million patients diagnosed with different primary sites of cancer (21 sites for males and 20 sites for females) were analyzed using the KM method.
- For graphical clarity reasons, only the 5-year survival plots and five-years after diagnosis using the Kaplan-Meier survival estimator were shown. Survival data of 3.94 million patients with 23 primary-site cancers were plotted with the age at diagnosis in the form of line graphs. Error bars demonstrated the probability of error at 95% confidence level.

Results

- The improvement of cancer survival for most of the cancers studied may be attributed to the wide range of cancer-specific factors which manipulate the survival of these patients. The aim of this study is to investigate the changes in the survival profile over age for patients with the most incident cancers.
- One, three, and five-year survival data for approximately 3.54 million patients diagnosed with different primary sites of cancer were analyzed using the KM method.
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Discussion

- The cause-specific survival presented in this study is an estimate of the survival of patients with a particular cancer, not from primary cancer only, not from a secondary cancer or other associated causes.
- The KM estimator calculates the survival probability at a defined period of time based on calculation of the survival estimate at the end of each month of this period. This method allows for early exclusion of those who deceased during the specified time interval and for prompt censoring of the cases born from follow-up, with regular adjustment of the at-risk group (denominator) on a monthly basis, in order to introduce an accurate net survival estimate for the defined period of time.
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Fig. 1: Cancer survival declines with the increase in the age of diagnosis. In leukemia and prostate cancer, there was a transient improvement of survival between the 21 and 25 years of age for the former and (40-49) years for the latter before the fall off phase took place. (Fig. 2).

- The relation of cancer survival to the age of diagnosis is a two-phased survival model. Phase I shows a gradual decrease of survival with the age of diagnosis. Phase II is a rapid fall-off phase which usually occurs at (70-80) years of age. Exceptions: Phase I is absent (and replaced with plateau phase e.g. colorectal, uterine, prostate cancers, and melanoma. Also, phase II may occur at earlier age (mainly 40 years old) e.g. brain, Hodgkin lymphoma, and leukemia. (Fig. 2 & 5)."