Statistics on cancer patient survival of relevance for patients and clinicians

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Annual meeting of the Association of Nordic Cancer Registries
2–4 Sept 2009

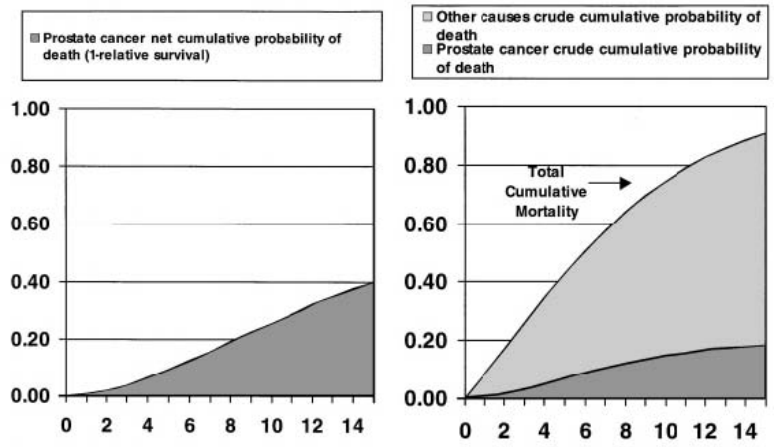
Overview

- Patient survival is the most important single measure of cancer patient care (the diagnosis and treatment of cancer) and is of considerable interest to clinicians, patients, researchers, politicians, health administrators, and public health professionals [1].
- However, relatively little attention has been paid to the fact that each of these consumers of survival statistics have quite different needs.
- The standard approach of estimating net survival (relative survival or cause-specific survival) is useful for comparing populations but not necessarily relevant to individual patients since such estimates are interpreted in the hypothetical scenario where cancer is the only possible cause of death.
- In this presentation I will discuss possible approaches to estimating measures of patient survival relevant for patients and clinicians.

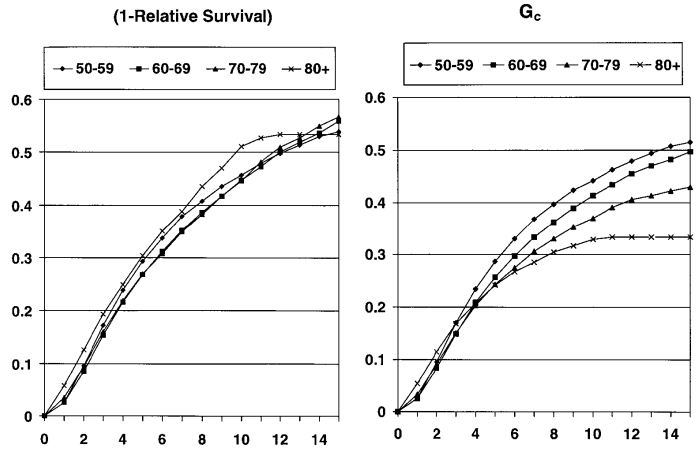
Interpreting relative survival estimates

- The cumulative relative survival ratio can be interpreted as the proportion of patients alive after i years of follow-up in the hypothetical situation where the cancer in question is the only possible cause of death.
- 1-RSR can be interpreted as the proportion of patients who will die of cancer within i years of follow-up in the hypothetical situation where the cancer in question is the only possible cause of death.
- We do not live in this hypothetical world (where we estimate what is called the net probability of death). Estimates of the proportion of patients who will die of cancer in the presence of competing risks can also be made (crude probabilities of death).
- Cronin and Feuer (2000) [2] extended the theory of competing risks to relative survival; their method is implemented in the Stata command `strs`.

Net (left) and crude (right) probabilities of death in men with localized prostate cancer aged 70+ at diagnosis.



Net (left) and crude (right) probabilities of death due to cancer in women with regional breast cancer.



Estimating crude and net mortality for individual data

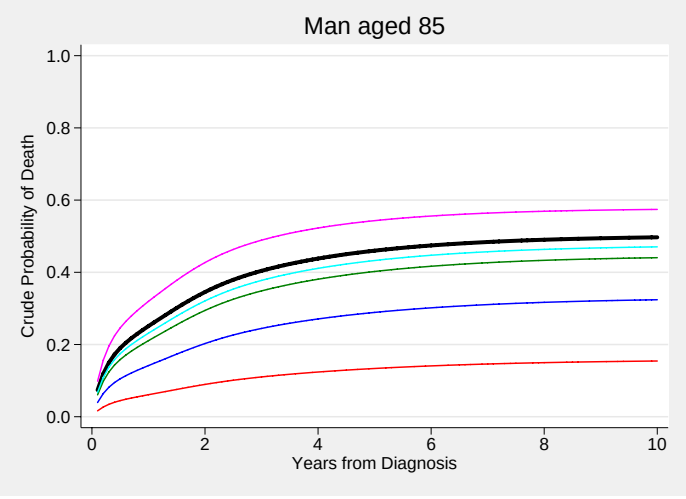
- Lambert et al (*Statistics in Medicine* in press) [3] showed how to estimate crude and net probabilities based on flexible parametric models for relative survival.
- This approach avoids having to split the timescale and facilitates easy modelling of continuous covariates. That is, we can obtain predictions for individual values of age or other covariates.
- Contact Paul or me if you'd like a preprint.

How do we compare treatments? What does a hazard ratio of 0.8 mean?

- The standard measure used for comparing treatments, the hazard ratio, is typically a ratio of net mortality rates.
- That is, a ratio of two rates each estimated in the hypothetical world where one cannot die of anything other than cancer.
- Are such estimates easily interpretable in the clinical setting?

Crude probability of death due to prostate cancer

Which line represents the crude probability for a HR of 0.8?



The answer

Treatment comparison and risk communication in the clinical setting

- Informal surveys we have conducted among colleagues suggest that not even epidemiologists and biostatisticians have a good intuitive feel for how a specified hazard ratio will impact survival probabilities.
- From a clinical perspective it may be more useful to compare crude probabilities of death, ideally as natural frequencies.

Illustration of the use of natural frequencies to communicate expected 10-year prognosis under two alternative treatments. Treatment B has a 20% lower net mortality than treatment A (i.e., the hazard ratio is 0.8).

	Age 55		*Age 85*	
Outcome	*A*	*B*	*A*	*B*
Die of cancer	55	48	46	40
Die of other causes	2	2	32	35
Alive	43	50	22	25
Total	100	100	100	100

Final slide

- Conclusion: survival statistics can and should be tailored to the needs of the consumer.
- Cure models represent another approach for providing information of direct clinical relevance (and they also happen to be useful for other users).
- Can also estimate crude and net mortality from other models (e.g., cure models).
- Next step is to apply these methods to data from clinical cancer registries to obtain individual level predictions as a function of treatment, patient characteristics, and tumour characteristics.

References

[1] Dickman PW, Adami HO. Interpreting trends in cancer patient survival. *J Intern Med* 2006; **260**:103–117.

[2] Cronin K, Feuer E. Cumulative cause-specific mortality for cancer patients in the presence of other causes: a crude analogue of relative survival. *Stat Med* 2000;**19**:1729–40.

[3] Lambert PC, Dickman PW, Nelson CP, Royston P. Estimating the crude probability of death due to cancer and other causes using relative survival models. *Stat Med* 2009;(in press).