Assessing the impact of including variation in general population mortality on standard errors of relative survival and loss in life expectancy

Yuliya Leontyeva, Hannah Bower, Oskar Gauffin, Paul C. Lambert, and Therese M.-L. Andersson

Introduction

The relative survival ratio (RS) is often used in population-based cancer studies to estimate cancer-specific survival without requiring cause of death information.

Instead, other cause (or expected) mortality is assumed to be the same as the mortality in the general population, given a specific covariate pattern and obtained from population life tables.

Another measure, where population life tables are used, is Loss in life expectancy (LLE). LLE is the difference in life expectancy for the general population and life expectancy for cancer patients.

The expected mortality is assumed to be known (fixed), i.e. measured without uncertainty.

Aim of the study

To evaluate the existing approach of estimating standard errors (SE) of 5-year RS and LLE in comparison to if uncertainty in the expected mortality is taken into account.

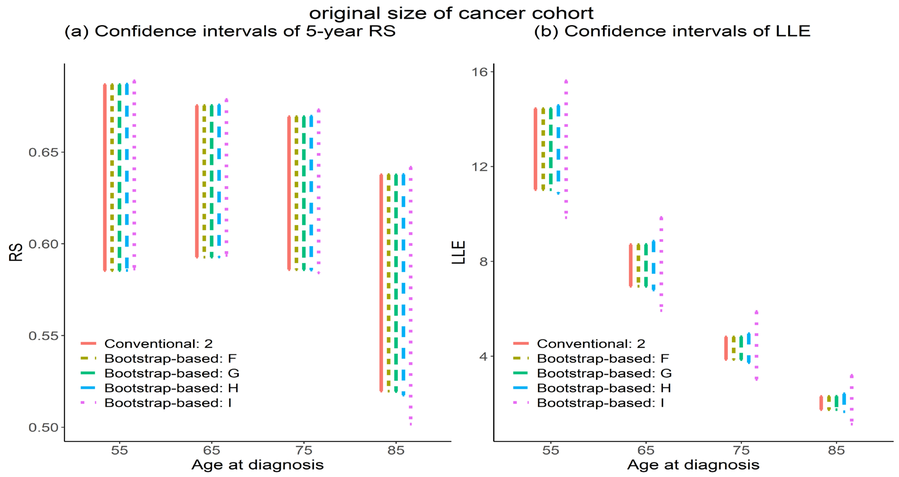
The analysis was performed with different levels of stratification and sizes of the general population used for creating expected mortality rates.

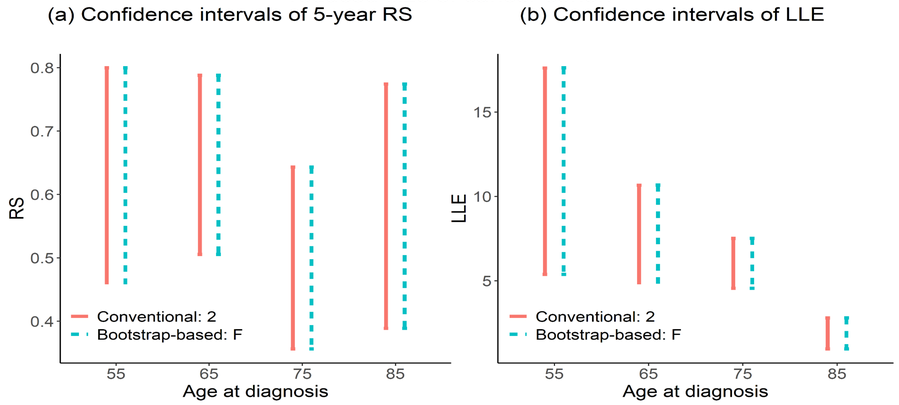
Table 2: Marginal estimates of 5-year RS and LLE

Method	Setting / scenario	5-year Relative survival (RS) PE	SE	LCI	UCI	RP	Loss in life expectancy (LLE) PE	SE	LCI	UCI	RP
Conventional	1	0.632	0.011	0.611	0.654	0.00	5.40	0.16	5.09	5.71	0.00
Bootstrap-based	A	0.632	0.011	0.611	0.654	0.01	5.40	0.16	5.09	5.71	0.11
	D	0.632	0.013	0.608	0.658	30.55	5.40	0.28	4.85	5.95	214.25
Conventional	2	0.631	0.011	0.610	0.653	0.00	5.40	0.16	5.09	5.71	0.00
Bootstrap-based	F	0.631	0.011	0.610	0.653	0.02	5.40	0.16	5.09	5.71	0.11
	I	0.631	0.013	0.606	0.656	30.06	5.58	0.32	4.95	6.21	313.01

RP compares the conventional with bootstrap-based method (%)
LLE is presented in years

Results





Conventional refers to the standard method for estimating SEs, where general population mortality is assumed to be measured without uncertainty.
Bootstrap-based refers to the parametric bootstrap approach used for including uncertainty in population mortality rates in the estimation of SEs.
Results are presented for men, aged 55, 65, 75 and 85 years at diagnosis and LLE estimates for the Stockholm region.

Table 1: Outline of different scenarios to incorporate uncertainty in the expected mortality

Scenario	cancer cohort used	size of general population used for population mortality	population mortality stratified by	corresponding conventional setting
A	full	original	age, year, sex	1
B	full	reduced to 10%	age, year, sex	1
C	full	reduced to 0.5%	age, year, sex	1
D	full	reduced to 0.05%	age, year, sex	1
E	reduced to 10%	reduced to 10%	age, year, sex	1S[a]
F	full	original	age, year, sex, region	2
G	full	reduced to 10%	age, year, sex, region	2
H	full	reduced to 0.5%	age, year, sex, region	2
I	full	reduced to 0.05%	age, year, sex, region	2
J	reduced to 10%	reduced to 10%	age, year, sex, region	2S[a]

[a] S stands for small and refers to the setting to investigate what would be observed for a smaller population

Conclusions

When the general population mortality rates are based on the whole population (all people living in a country), the uncertainty in the estimates of the expected measures can be ignored.

However, the smaller population used for creating the expected mortality rates, the larger impact. Therefore, when expected measures are based on a smaller population, this uncertainty should be taken into account.

Ignoring uncertainty in expected measures based on a smaller population especially for LLE and marginal values can lead to too small SEs and therefore, confidence intervals too narrow.

Karolinska Institutet
Yuliya Leontyeva
PhD student, Medical Epidemiology and biostatistics (MEB)
Email: yuliya.leontyeva@ki.se

Karolinska Institutet