Annals of Oncology 26: 1263–1268, 2015
doi:10.1093/annonc/mdv131
Published online 3 March 2015

Life expectancy of colon, breast, and testicular cancer patients: an analysis of US-SEER population-based data

R. Capocaccia[1,2*], G. Gatta[1] & L. Dal Maso[3]

[1]*Department of Preventive and Predictive Medicine, Evaluative Epidemiology Unit, Foundation National Cancer Institute, Milan;* [2]*National Center of Epidemiology, Cancer Epidemiology Unit, National Institute of Health, Rome;* [3]*Epidemiology and Biostatistics Unit, CRO Aviano National Cancer Institute IRCCS, Aviano, Italy*

Received 31 October 2014; revised 12 February 2015; accepted 23 February 2015

Background: Cancer survivorship is an increasingly important issue in cancer control. Life expectancy of patients diagnosed with breast, colon, and testicular cancers, stratified by age at diagnosis and time since diagnosis, is provided as an indicator to evaluate future mortality risks and health care needs of cancer survivors.

Patients and methods: The standard period life table methodology was applied to estimate excess mortality risk for cancer patients diagnosed in 1985–2011 from SEER registries and mortality data of the general US population. The sensitivity of life expectancy estimates on different assumptions was evaluated.

Results: Younger patients with colon cancer showed wider differences in life expectancy compared with that of the general population (11.2 years in women and 10.7 in men at age 45–49 years) than older patients (6.3 and 5.8 at age 60–64 years, respectively). Life expectancy progressively increases in patients surviving the first years, up to 4 years from diagnosis, and then starts to decrease again, approaching that of the general population. For breast cancer, the initial drop in life expectancy is less marked, and again with wider differences in younger patients, varying from 8.7 at age 40–44 years to 2.4 at ages 70–74 years. After diagnosis, life expectancy still decreases with time, but less than that in the general population, slowly approaching that of cancer-free women. Life expectancy of men diagnosed with testicular cancer at age 30 years is estimated as 45.2 years, 2 years less than cancer-free men of the same age. The difference becomes 1.3 years for patients surviving the first year, and then slowly approaches zero with increasing survival time.

Conclusions: Life expectancy provides meaningful information on cancer patients, and can help in assessing when a cancer survivor can be considered as cured.

Key words: cancer, mortality, survival, cure, SEER

introduction

Cancer survivors are a fast-growing population group, due to demographic changes, spread of early diagnostic and of organized screening activities, improvement of treatments, and increasing survival. They are a highly heterogeneous group, including people at all phases of the disease and with different needs in terms of health care and social support [1].

Relative survival and conditional relative survival, the latter defined as the probability of surviving to a next time period for a patient alive at a given time since diagnosis, are widely used indicators for health care purposes [2], to provide patients information on their health status, and to distinguish who, among them, can be considered cured of their cancer [3, 4]. Survival indicators are particularly important and informative during the first years of the patients' cancer experience, when the death risk is high and the main concerns are obviously addressed to cancer progression or recurrence. When time since cancer diagnosis increases without clinical manifestations of the disease, patients' perspectives might tend to change. Cancer death risk becomes lower and comparable with that of other illnesses; thus the patients' perspective tends to approach that of cancer-free individuals. Conditional relative survival measures, usually close to unity (e.g. 90% or 95%) and estimated for an arbitrary time frame (e.g. 5 or 10 years), may become difficult to be perceived and interpreted.

Life expectancy is a widely used indicator in demography and epidemiology. When applied to cancer survivors, it may provide a meaningful and alternative lifetime measure of how much cancer is still affecting the patient's future prospects. To this aim, life expectancy has been since long repeatedly proposed [5–7], but never got into current use, mainly because it depends on patient survival rates from age at diagnosis to the highest possible expected age; data not commonly available from cancer registries. However, the increasing availability of population-based survival data with long periods of follow-up, and the use

*Correspondence to: Dr Riccardo Capocaccia, Evaluative Epidemiology Unit, Department of Preventive and Predictive Medicine, Fondazione Istituto Nazionale Tumori, via Venezian 1 20133 Milan, Italy. Tel: +39-0223903518; E-mail: riccardo.capocaccia@istitutotumori.mi.it

of the 'period method' in the survival estimates [8], makes it easier for the application of life expectancy methodology.

In this paper, we present the life expectancy estimates for cancer types selected as examples of malignancies characterized by different prognosis, in terms of overall survival and timing of cancer-related deaths. SEER registries data for cancers of the breast, colon, and testis were used to provide life expectancy of cancer survivors by sex, age at diagnosis, and attained age, in comparison with the corresponding values in the general population. We will also discuss the implication of the results in the definition of cured cancer survivors and in the identification of a time to cure based on life expectancy indicator.

material and methods

Life expectancy of the US population was computed, by sex and single age, from the 2009 mortality data published by the USA Social Security Administration [9]. Survival data of cancer patients were extracted from the SEER public use dataset [10] selecting nine registries with complete data, during the period 1975–2011 (San Francisco-Oakland, Connecticut, Detroit-Metropolitan, Hawaii, Iowa, New Mexico, Seattle-Puget Sound, Utah, and Atlanta-Metropolitan area). For the demonstrative purpose of this work, we selected three cancer sites with different natural history and, within each site, representative age classes at diagnosis, i.e. colon (ages: 45–49, 50–54, 55–59, and 60–64), female breast (ages: 40–44, 55–59, and 70–74), and testicular (age: 24–34) cancers. The life expectancy estimates were attributed to the central value of each age class of diagnosis, i.e. 47, 52, 57, and 62 years for colon, 42, 57, and 72 years for breast, and 30 years for testicular cancer patients.

Details on statistical methods are given as supplementary material, available at *Annals of Oncology* online. In brief, life expectancy of the general population was calculated by the standard period life table method [11], based on age-specific survival probabilities observed in all birth cohorts living during a single calendar period. The highest possible age was set to 110 years.

Life expectancy of cancer patients was calculated in three steps. First, relative survival of cancer patients diagnosed in 1985–2011 with follow-up up to 2012 was estimated by the period method [8] and the Ederer-2 approach [12]. The cancer hazard of the patients was then derived by age at diagnosis and age attained. As a second step, cancer hazard up to age 110 years, not otherwise observable using our 25-year long dataset, has been estimated for all patients diagnosed before age 85 years by the 5-year moving average method. The final step was adding the cancer mortality risk to that of other causes to calculate the life expectancy of cancer patients. Standard errors of life expectancy estimates for cancer patients were computed by the delta method. Those for the general population were considered as zero.

A sensitivity analysis was also carried out to assess the impact of two different assumptions for death risk beyond the 25-year observation period. The first, more favorable, assumption supposed no excess risk of death after 25 years since diagnosis. The opposite adverse assumption postulated that the excess risk of death after 25 years since diagnosis would be equal to the upper 95% confidence bound of the observed one, averaged over 20–25 years since diagnosis.

results

The observed annual conditional relative survival for each of the considered cancers and age classes is represented in Figure 1.

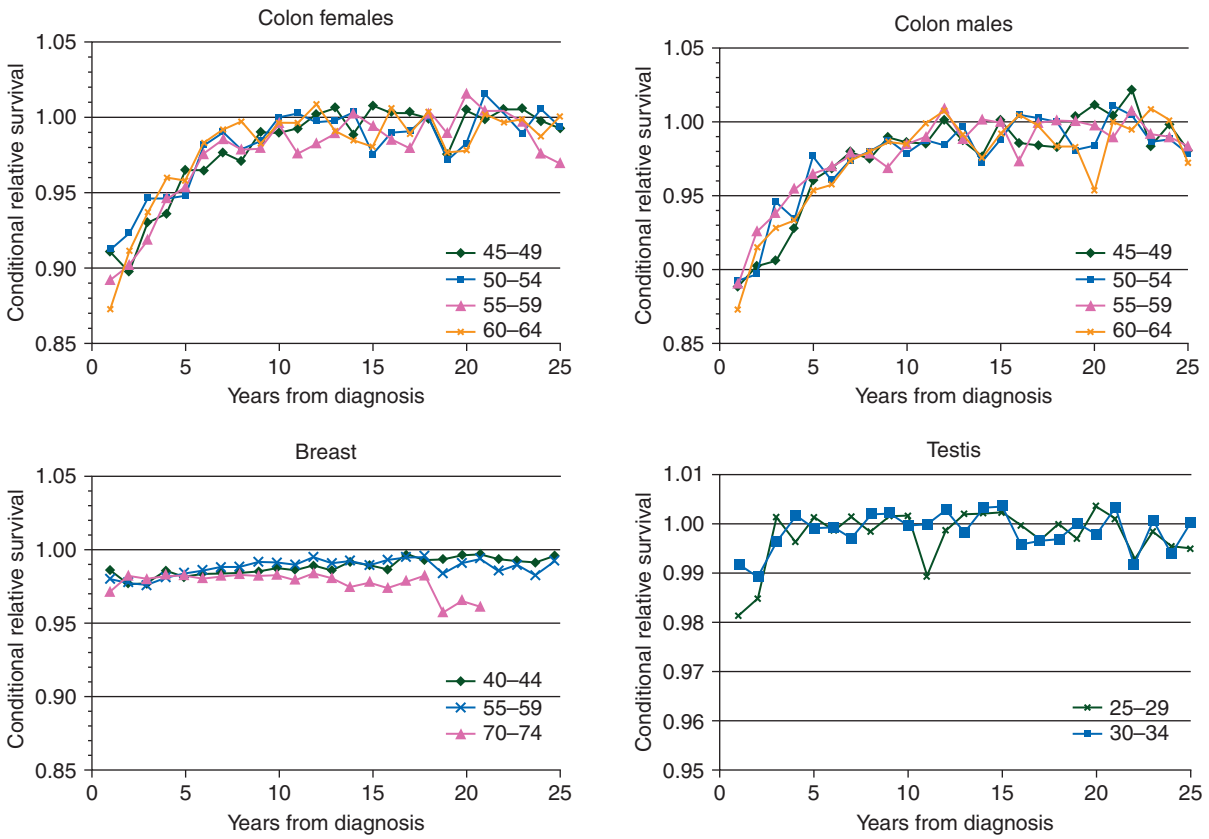

Figure 1. Annual (1-year) conditional relative survival according to time since diagnosis, by cancer type and age class at diagnosis. Period analysis of SEER 9-registries data, period of diagnosis 1985–2011, follow-up 2009–2011.

For colon cancer, the survival probability during the first year was about 90% in men and women. Then it increased, reaching a level close to 100%. On average, over the entire 45–64 years age group, the annual percent probability of surviving one additional year, starting from year 10 after the diagnosis, was between 99.0% and 99.8%. Annual survival probabilities of breast cancer patients are higher than those for colon cancer, but they approach unity in a longer time. After the 10th year of follow-up, average annual probabilities of patients diagnosed at ages 42 and 57 years remained high (99.2% and 99.1%, respectively) while those of women diagnosed at 72 years tended to decrease to about 97%–98%. Young men diagnosed with testicular cancer presented an excess mortality only during the first 2 years post diagnosis, whereas the annual survival probabilities increased to about 99.9%.

Figure 2 shows the trends in life expectancy of cancer patients according to selected ages at diagnosis, together with the life expectancy of the general population. The corresponding figures are reported in Table 1 for selected time points (and in supplementary Tables S1–S3, available at *Annals of Oncology* online for single years). When diagnosed with colon cancer, patients had a dramatic drop in their life expectancy versus the one they could have in absence of disease. The loss was greater for the younger ages at diagnosis, being 11.2 years, with 95% confidence intervals (CI) 9.9–12.4 for women and 10.7 years (95% CI: 9.4–12.0) for men at age 47; at age 62 it was estimated to be 6.3 (95% CI: 5.5–7.1) and 5.8 (95% CI: 5.0–6.6), respectively. Life expectancy progressively increased in patients surviving during the first years, up to 4 years since diagnosis, and then started to decrease again, progressively approaching that of the general population. At 5 years after diagnosis, women with colon cancer had a loss in life expectancy, with respect to cancer-free women of the same age, varying from 3.8 years (95% CI: 2.5–5.1) at age 47 to 1.6 years (95% CI: 0.8–2.4) at age 62. Slightly higher values were estimated in men, from 4.1 (95% CI: 2.8–5.4) to 1.8 (95% CI: 1.0–2.5) years, respectively. The difference became less than 2 years at 4–5 years after diagnosis for patients diagnosed at age 62, at 6–7 years for those diagnosed at age 57, at 8–9 years and 13–14 years when diagnosed at ages 52 and 47. For all the patients, the loss in life expectancy became lower than 1 year when they reached age 70, regardless of sex and age at diagnosis.

For breast cancer, the initial drop in life expectancy was less marked than that for colon cancer and again greater in younger patients, varying from 8.7 (95% CI: 7.9–9.5) years at age 42 to 4.6 (95% CI: 3.8–5.4) years at age 57, and finally to only 2.4 (95% CI: 0.9–3.9) years at age 72. After diagnosis, life expectancy did not present any temporary increase with time and

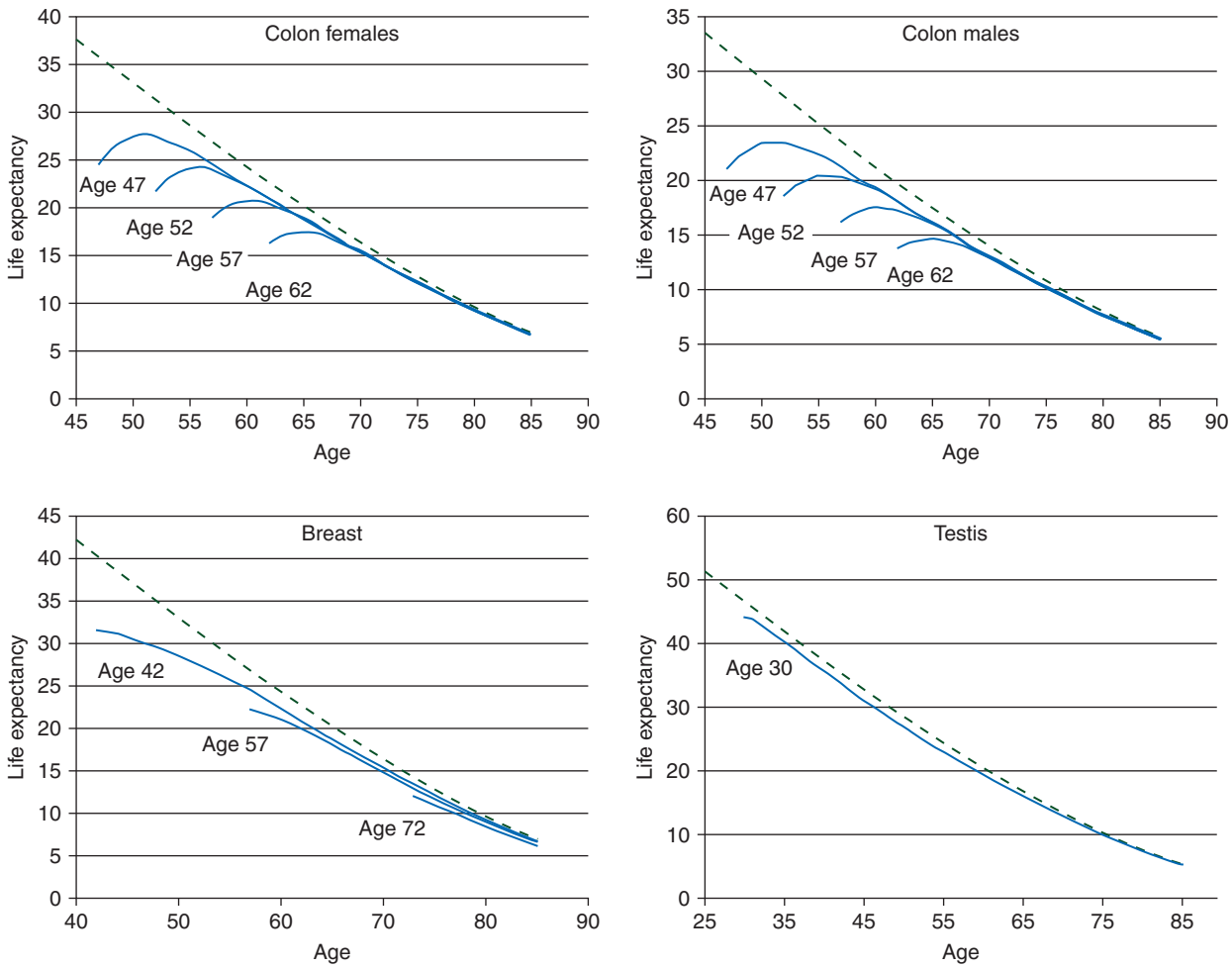

Figure 2. Life expectancy of the general population (dashed line) and of cancer patients according to attained age, by cancer type, and age at diagnosis. Analysis of SEER 9-registries data, period 2009–2011.

Table 1. Life expectancy (LE) of cancer patients, corresponding standard errors (se), and years lost (YL) in comparison with the general population, by cancer type, age, and time since diagnosis

Time since diagnosis (years)	LE	YL	(se)	LE	YL	(se)	LE	YL	(se)	LE	YL	(se)
	Age 47			Age 52			Age 57			Age 62		
	Colon—females											
0	24.6	11.2	(0.7)	21.8	9.4	(0.6)	19.1	7.8	(0.5)	16.3	6.3	(0.4)
1	26.0	8.8	(0.7)	23.0	7.3	(0.6)	20.0	6.0	(0.5)	17.0	4.8	(0.4)
2	26.9	7.0	(0.7)	23.7	5.8	(0.6)	20.5	4.6	(0.5)	17.4	3.6	(0.4)
3	27.4	5.6	(0.7)	24.1	4.5	(0.6)	20.7	3.6	(0.5)	17.4	2.8	(0.4)
4	27.8	4.4	(0.7)	24.3	3.5	(0.6)	20.8	2.7	(0.5)	17.4	2.0	(0.4)
5	27.5	3.8	(0.7)	23.9	2.9	(0.6)	20.4	2.2	(0.5)	17.0	1.6	(0.4)
10	24.6	2.3	(0.6)	20.9	1.7	(0.5)	17.4	1.2	(0.4)	14.1	0.8	(0.3)
15	20.9	1.7	(0.4)	17.4	1.2	(0.4)	14.1	0.8	(0.3)	11.0	0.5	(0.2)
20	17.5	1.2	(0.3)	14.1	0.8	(0.2)	11.0	0.5	(0.2)	8.2	0.3	(0.1)
	Colon—males											
0	21.2	10.7	(0.6)	18.8	8.9	(0.6)	16.3	7.3	(0.5)	13.9	5.8	(0.4)
1	22.3	8.7	(0.7)	19.6	7.2	(0.6)	17.0	5.8	(0.5)	14.4	4.6	(0.4)
2	23.0	7.2	(0.7)	20.1	5.9	(0.6)	17.4	4.7	(0.5)	14.6	3.6	(0.4)
3	23.6	5.8	(0.7)	20.6	4.6	(0.6)	17.6	3.6	(0.5)	14.8	2.8	(0.4)
4	23.5	5.0	(0.7)	20.5	3.9	(0.6)	17.5	3.0	(0.5)	14.5	2.3	(0.4)
5	23.6	4.1	(0.7)	20.4	3.2	(0.6)	17.3	2.4	(0.5)	14.3	1.8	(0.4)
10	21.4	2.2	(0.6)	18.1	1.6	(0.5)	15.0	1.1	(0.4)	12.0	0.7	(0.3)
15	18.1	1.6	(0.5)	15.0	1.1	(0.4)	12.0	0.7	(0.3)	9.3	0.4	(0.2)
20	15.0	1.1	(0.3)	12.0	0.7	(0.2)	9.3	0.4	(0.2)	6.9	0.2	(0.1)
	Breast									Testis		
	Age 42			Age 57			Age 72			Age 30		
0	31.6	8.7	(0.4)	22.3	4.6	(0.4)	12.5	2.4	(0.8)	45.2	1.3	(0.5)
1	31.4	8.0	(0.4)	21.9	4.1	(0.4)	12.0	2.2	(0.7)	44.9	0.8	(0.4)
2	31.2	7.3	(0.4)	21.5	3.6	(0.4)	11.5	2.0	(0.7)	44.0	0.7	(0.4)
3	30.7	6.8	(0.4)	21.1	3.2	(0.4)	10.9	1.8	(0.7)	43.1	0.7	(0.4)
4	30.4	6.3	(0.4)	20.5	2.9	(0.4)	10.4	1.7	(0.6)	42.2	0.7	(0.4)
5	29.9	5.8	(0.4)	20.0	2.7	(0.3)	9.9	1.6	(0.6)	41.3	0.6	(0.4)
10	27.5	3.7	(0.3)	16.8	1.8	(0.3)	7.5	1.0	(0.4)	36.8	0.5	(0.3)
15	24.6	2.3	(0.2)	13.5	1.3	(0.2)	5.4	0.6	(0.3)	32.1	0.7	(0.2)
20	20.8	1.8	(0.2)	10.5	1.0	(0.1)	4.0	0.2	(0.2)	28.0	0.5	(0.1)
30	14.0	0.8	(0.0)	5.7	0.3	(0.0)	–	–	–	20.2	0.3	(0.1)
40	8.2	0.3	(0.0)	–	–	–	–	–	–	13.3	0.1	(0.0)

Analysis of SEER 9-registries data, period of diagnosis 1985–2011, follow-up 2009–2011.

started to decrease immediately, but less than in the general population, slowly approaching that of cancer-free women. The differences in life expectancy in comparison with cancer-free women after 5 years from diagnosis were 5.8 (95% CI: 5.1–6.5) years at age 42, 2.7 (95% CI: 2.0–3.3) years at age 57, and 1.6 (95% CI: 0.4–2.7) years at age 72. They became less than 2 years after 18, 10, and 3 years since diagnosis, and less than 1 year after 28, 20, and 11 years, respectively.

Life expectancy of men diagnosed with testicular cancer at age 30 was estimated as 45.2 years, 1.3 (95% CI: 0.4–2.3) years less than cancer-free men of the same age. The difference became 0.8 years for patients surviving the first year, then gradually approaching zero.

The differences between life expectancy estimates obtained under the more or less favorable long-term hazard assumptions were generally low (supplementary Tables S4 and S5, available at *Annals of Oncology* online). The highest difference was found for younger breast cancer patients (1.1 years at diagnosis; 1.2, 1.3, and 1.5 after 5, 10, and 20 years, respectively). The lowest difference in life expectancy estimates was for male colon cancer patients aged 62, for whom the two extreme estimates practically overlapped over the entire period of follow-up.

discussion

In this paper, life expectancy of colon, breast, and testicular cancer patients and corresponding differences with respect to cancer-free persons were estimated by age and time since diagnosis. During the first years after cancer diagnosis, young patients face a much higher loss in life expectancy than older ones.

Thereafter, the patients' life expectancy gradually approaches, but never reaches, that of the general population.

The present results were based on a 25-year-long series of incidence and follow-up. Potentially, a dataset with longer follow-up could have been considered, since all the selected SEER registries were started in 1975 at the latest. However, we chose not to use data for patients diagnosed before 1985, as the diagnostic criteria and the therapeutic options were very different than those available during the last decades. A small but not nil excess of cancer risk in 2009–2012 was estimated for patients diagnosed in 1985–1994 who were still alive at the beginning of 2009. Actually, the excess risk during the same period was even higher for patients diagnosed in 1975–1984 (data not shown).

The long-term persistence of excess mortality for cancer patients could be due to several causes. Death due to relapse of the original cancer can occur for decades in breast cancer patients, but it is unlikely after 5 years for colon or testis cancers. Cancer survivors remain exposed to excess mortality attributable to second cancers, to long-term effects of treatments, or to common risk factors shared with other diseases. Higher risk of second cancers has been reported for all the considered malignancies [13]. Cancer survivors tend to have a poorer general health than people without a history of cancer. Cardiovascular diseases are a major health issue among breast and testis cancer survivors, with especially high risks of long-term side-effects in patients who receive cytotoxic and radiation therapies [14, 15]. An increased non-cancer mortality was shown both in breast and testis cancer survivors [14, 16]. Diet and poor physical activity are major risk factors for breast and colon cancers and for cardiovascular diseases [17] and have been also recognized to influence cancer recurrence [15]. Obesity is a known risk factor for breast, colon, and testis cancers [18]. Obesity, with diabetes and cardiovascular diseases, is a manifestation included in the 'metabolic syndrome', frequently observed among cancers survivors [15]. Diabetes plays an especially significant role in the increased number of non-cancer-related deaths among survivors [15].

Two previous works have estimated life expectancy of cancer patients at diagnosis. Using a cohort survival approach with breast cancer patients diagnosed in Finland in 1956–1970, Hakama and Hakulinen [5] estimated life expectancy at diagnosis ranging from 17.2 to 19.5 years for ages at diagnosis 45–54 and from 12.0 to 8.8 years at ages 55–64, depending on the assumption made for long-term unobserved excess mortality. The sensitivity of life expectancy estimated from the assumed long-term excess mortality vanished for age at diagnosis above 55 years. Andersson et al. [6] estimated by flexible survival models, and again with a cohort approach, the life expectancy of Swedish patients for four cancer types diagnosed in 1961–1970. For colon cancer, they reported a life expectancy at diagnosis of 9.9 and 6.1 years for patients diagnosed at ages 50–59 and 60–69, respectively. For breast cancer, the corresponding life expectancy estimates were 13.4 and 9.8 years. All these estimates were substantially lower than those presented in this work. This could be largely due to the less recent data period and to the use of cohort (in previous studies) versus period (in this study) survival approach, the two approaches differing with respect to aims and results. The classical cohort approach provides information on the survival experience of a real group of patients diagnosed in a same period of time, and it is therefore valid for calculating long-term survival of cases diagnosed several decades ago. Such estimates are seldom representative of the survival expected in recently diagnosed patients, due to continuous progresses in cancer diagnosis, risk-based classification, and treatments. The period approach used in this analysis provides survival estimates based on all the patients alive during the latest available period of follow-up, whenever diagnosed in the past. Higher period-based life expectancy estimates, with respect to those cohort-based, are consistent with the increasing survival reported over time.

Extrapolation of long-term survival beyond the observed follow-up period was made by assuming excess hazard of patients to be asymptotically constant at the value observed, around the year 2010, in patients diagnosed since 20 to 25 years before. This assumption may be conservative, as the latest cancer treatments and an improved surveillance should have reduced long-term treatments toxicity and side-effects. Use of parametric [6] or semi-parametric [19] modeling in future applications could provide a better insight into this issue and more flexible statistical tools for life expectancy estimation.

Reaching the same life expectancy of cancer-free people is often indicated as the condition for defining survivors as 'cured from cancer'. The life expectancy gap of cancer survivors with respect to age matched cancer-free people can be interpreted as a measure of how far from being cured they can be considered. For example, a cutoff difference of less than 2 years would define breast cancer patients as cured 3 years after a diagnosis at age 72 and 18 after a diagnosis at age 42. Previous works on cancer survivors defined cured patients as those surviving until their conditional 5-year relative survival became higher than 95% [3, 4, 20]. In our study, this threshold was reached by 42-year-old breast cancer patients at age 54, when life expectancy was 3 years shorter than that of cancer-free coetaneous. Breast cancer patients diagnosed at age 72 never reached 5-year conditional relative survival >95%, but 12 years after diagnosis they reached a less than 1 year difference in life expectancy, compared with the general population. For colon cancer patients, this threshold was reached after 7 years in women and after 8 years in men. After the same number of years, female patients had a life expectancy difference varying from 3 years for the youngest to 1.2 years for the oldest age groups. Corresponding values for men decreased from 2.7 to 1.0 years. Finally, testicular cancer patients diagnosed at age 30 should be considered as cured in less than 1 year after diagnosis.

All indicators include arbitrary decisions on the relevant cutoff. The use of life expectancy limits the decision to one parameter only (the number of remaining life years lost) while for survival based indicators both conditional relative survival level (95%, 90%, etc.) and time of observation (5-, 10-years, etc.) have to be selected [4]. On the other hand, indicators based on conditional relative survival may have the same meaning for patients of different ages and sex, while a same loss in life expectancy may be differently perceived at different patients' ages.

In conclusion, life expectancy estimates can provide a different and complementary cancer cure indicator with respect to the relative survival-based criteria. For younger patients, in particular, estimates of life expectancy could be more appropriate than relative survival estimates in capturing those issues arising from the medical and emotional impact of a cancer diagnosis.

acknowledgements

We thank Paolo Baili, Stefano Guzzinati and Milena Sant for sound and helpful comments in the drafting of the manuscript. The authors wish to thank also Mrs. Luigina Mei for editorial assistance.

funding

This work was supported by the Italian Association for Cancer Research (AIRC) (grant no. 11859).

disclosure

The authors have declared no conflict of interests.

references

1. Rowland JH, Hewitt M, Ganz PA. Cancer survivorship: a new challenge in delivering quality cancer care. J Clin Oncol 2006; 24: 5101–5104.
2. Berrino F, Verdecchia A, Lutz JM et al. Comparative cancer survival information in Europe. Eur J Cancer 2009; 45: 901–908.
3. Janssen-Heijnen ML, Gondos A, Bray F et al. Clinical relevance of conditional survival of cancer patients in Europe: age-specific analyses of 13 cancers. J Clin Oncol 2010; 28(15): 2520–2528.
4. Dal Maso L, Guzzinati S, Buzzoni C et al. Long-term survival, prevalence, and cure of cancer: a population-based estimation for 818,902 Italian patients and 26 cancer types. Ann Oncol 2014; 25: 2251–2260.
5. Hakama M, Hakulinen T. Estimating the expectation of life in cancer survival studies with incomplete follow-up information. J Chron Dis 1977; 30: 585–597.
6. Andersson TML, Dickman PW, Eloranta S et al. Estimating the loss in expectation of life due to cancer using flexible parametric survival models. Stat Med 2013; 32 (30): 5286–5300.
7. Viscomi S, Pastore G, Dama E et al. Life expectancy as an indicator of outcome in follow-up of population-based cancer registries: the example of childhood leukaemia. Ann Oncol 2006; 17(1): 167–171.
8. Brenner H, Gefeller O. An alternative approach to monitoring cancer patient survival. Cancer 1996; 78: 2004–2010.
9. US Social Security Administration USA. Period Life Tables by sex and calendar year, 2009. http://www.ssa.gov/oact/STATS/table4c6.html (23 June 2014, date last accessed).
10. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Incidence—SEER 18 Regs Research Data (1973–2011 varying). NCI, DCCPS, Surveillance Research Program, Surveillance Systems Branch, 2014. www.seer.cancer.gov (5 July 2014, date last accessed), November 2013 submission.
11. Chang CL. The Life Table and its Applications. Malabar, FL: Krieger 1984.
12. Ederer F, Axtell LM, Cutler SJ. The relative survival: a statistical methodology. Natl Cancer Inst Monogr 1961; 6: 101–121.
13. Curtis RE, Freedman DM, Ron E et al. (eds). New Malignancies Among Cancer Survivors: SEER Cancer Registries, 1973–2000. NCI, NIH Publ. No. 05-5302. Bethesda, MD 2006.
14. Nolan MT, Lowenthal RM, Venn A et al. Chemotherapy-related cardiomyopathy: a neglected aspect of cancer survivorship. Intern. Med. J. 2014; 44(10): 939–950.
15. Aziz NM. Cancer survivorship research: State of knowledge, challenges and opportunities. Acta Oncol. 2007; 46: 417–432.
16. Fossa SD, Aass N, Harvei S et al. Increased mortality rates in young and middle-aged patients with malignant germ cell tumours. Br J Cancer 2004; 90: 607–612.
17. World Cancer Research Fund, American Institute for Cancer Research. Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective. Washington, DC: AICR 2007.
18. Nuver J, Smit AJ, Wolffenbuttel BH et al. The metabolic syndrome and disturbances in hormone levels in long-term survivors of disseminated testicular cancer. J Clin Oncol 2005; 23(16): 3718–3725.
19. Fang CT, Chang YY, Hsu HM et al. Life expectancy of patients with newly-diagnosed HIV infection in the era of highly active antiretroviral therapy. Q J Med 2007; 100: 97–105.
20. Baade PD, Youlden DR, Chambers SK. When do I know I am cured? Using conditional estimates to provide better information about cancer survival prospects. Med J 2011; 194: 73–77. Erratum in Med J Aust 2011; 194: 376.