

Trends in Breast Cancer Survival in Switzerland

Christine Bouchardy, Pierre Pury, Matthias Lorez, Kerri Clough-Gorr, Andrea Bordoni and the NICER Working Group*

*Members of the NICER Working Group for these analyses included: Basel - G. Jundt, Fribourg - B. Camey, Geneva - C. Bouchardy, Glarus & Graubünden - H. Frick, Ticino - A. Bordoni, Valais - I. Konzelmann

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Introduction

With 5,250 new diagnoses each year and incidence rates among the highest in Europe¹ breast cancer has to be considered a public health priority in Switzerland. Although incidence has increased over the past several decades, mortality has declined related to generalization of breast cancer screening and improved treatments. Continuous monitoring of incidence and survival is one of the many important tasks that cancer epidemiology provides in Switzerland. This study analyses trends in breast cancer survival in Switzerland using data from population-based cancer registries.

Methods

Data were extracted from the anonymised national cancer dataset managed by the Foundation National Institute for Cancer Epidemiology and Registration (NICER). We included all women age 15-99 years with first primary invasive breast cancer diagnosed 1988-2009 recorded at the cancer registries of Basel, Fribourg, Geneva, Graubünden/Glarus, Ticino, and Valais (BA, FR, GE, GR/GL, TI, VS). The six cancer registries recorded all incident breast cancer cases diagnosed in their resident population and

Table 1. Distribution of breast cancer cases by six cantonal cancer registries in the pooled dataset.

Cantonal Registry	Available years of incidence	Available cases	% of pooled dataset	Date(s) of last follow-up
GE	1980-2008	8087	32.7	2009
BS/BL	1981-2007	7396	29.8	2003-2009
VS	1989-2008	3288	13.0	2009
GR/GL	1989-2008	2442	10.0	2008-2009
TI	1996-2007	2856	11.5	2009
FR	2006-2009	707	3.0	2009
Total		24'776	100.0	

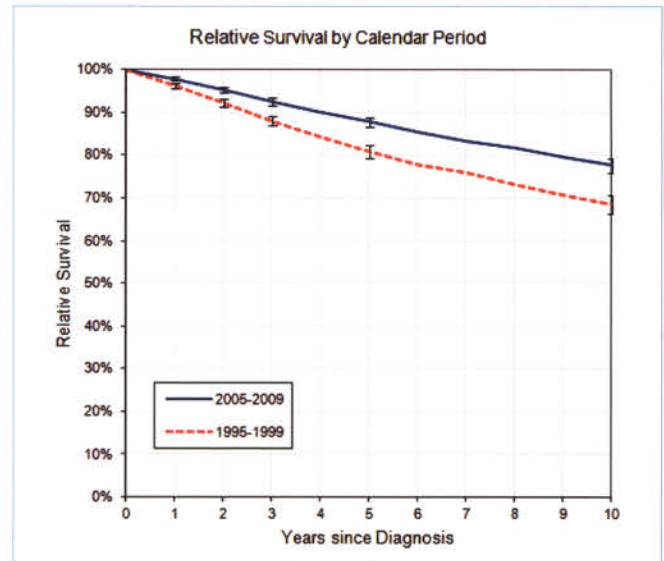


Figure 1. Breast cancer relative survival with 95% confidence intervals in two separate calendar periods for all six registries pooled.

regularly assessed women's survival through the end of 2009. We excluded all women diagnosed at death. The final sample included 24,776 breast cancer cases. The incidence date refers to the date of confirmation of diagnosis or the date of hospitalization if it preceded the diagnosis and was related to breast cancer. The last date of available follow-up varied between cancer registries (see Table 1). Completeness of case ascertainment for breast cancer has been determined in GE, GR/GL, TI and VS and found to be higher than the international standard of at least 90%.²

We calculated relative survival as the ratio of the observed probability of survival of cancer cases and general population of corresponding age, gender, calendar period of death, and geographical area (i.e. estimate of survival for a specific type of cancer accounting for general population mortality).^{3,4} Expected breast cancer survival proportions were estimated using Hakulinen's method⁵ applied to all-cause mortality tables supplied by the Swiss Federal Statistical Office. Death probabilities, transformed from age-, sex- and calendar year-specific death rates, were interpolated and smoothed using the Elandt-Johnson formula.⁶ Period analysis was used to derive more up-to-date relative survival estimates compared to those possible from traditional cohort analysis.⁷ Relative survival rates expressed as percentages were estimated using customized Stata for Windows[®] code adapted from the SAS[®] software program «periodh» by Brenner et al.^{8,9,10} In brief, period analysis describes the survival experience of cases defined by a specific period of follow-up dates. This is achieved by left censoring (truncation) of person-times at risk at the beginning of the specified period in addition to right censoring at its end. Trends in breast cancer survival were also calculated for different

age groups. All 95% confidence intervals (CI) were estimated based on Greenwood's formula.¹¹

Results

Table 1 presents the years of inclusion, the number of breast cancer cases, and the date of last follow-up by all six cancer registries. Breast cancer relative survival in Switzerland improved between 1995-1999 and 2005-2009 (Table 2, Figure 1). The greatest improvement in relative survival (nearly 10%) was observed for five or more years of breast cancer survival. Figure 2 displays trends in one-, five- and ten-year breast cancer relative survival 1988-2008 based on the seven successive three-year periods. Increase of short-term survival (\leq one-year after breast cancer diagnosis) was low (<5%). However, five- and ten-year breast cancer relative survival increased since 1991 but levelled off over the 2003-2005 and 2006-2008 periods. Figure 3 shows age-specific breast cancer relative survival for women 2005-2009. Below age 75 years, differences in relative survival were small (overlapping 95% CIs). However, women age 75 years and older had demonstrably poorer relative survival than younger women.

Discussion

As observed in other developed countries,^{12,13} this population-based study on trends in breast cancer survival in Switzerland shows important improvements over the last decades. The increase in survival was particularly high for medium (5-year) and long term (10-year) survival. This study also shows that survival among older women with breast cancer is much lower than in younger women.

The overall observed increase in survival may be attributed to both wider availability of up-to-date effective treatments and earlier diagnosis. A previous study in Ticino showed the consequences of widespread secondary prevention in Switzerland (i.e. mammography both in organized and opportunistic screening settings) were twofold: earlier stage diagnosis thus resulting in a better control

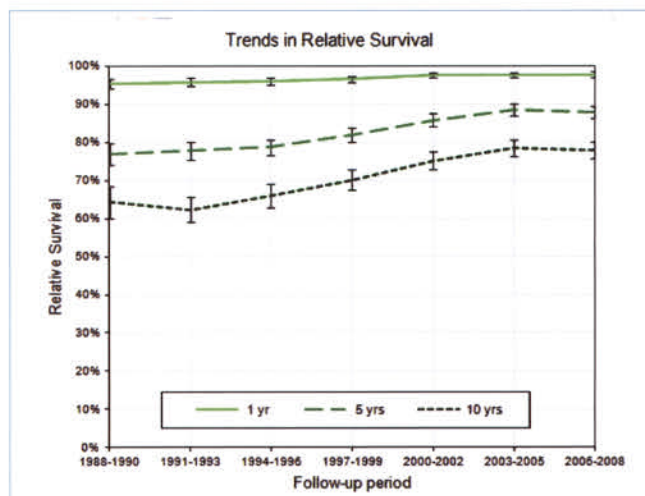


Figure 2. Trends in breast cancer relative survival rates with 95% confidence intervals from 1988 to 2008 in successive three-year intervals for all six registries pooled.

of the disease.¹⁴ Another important contributor to gains in survival has been linked to progress in loco-regional control by both surgery and radiotherapy as well as use of more effective adjuvant systemic therapy.¹⁵ In particular, increased access to high quality of care with widespread implementation of multidisciplinary case discussion and tumour boards in Switzerland may also have had an impact on these increased survival outcomes.¹⁵

Nonetheless and importantly, improvements in breast cancer survival in this study were age-specific. The lower survival rates among older women with breast cancer (age \geq 75 years) seen in Switzerland have also been described in other European countries.¹⁶ This reduced survival has been linked to suboptimal treatment in older breast cancer patients.¹⁷ The reasons underlying under-treatment of older women with breast cancer are notably: high prevalence of co-morbidities, lowered life expectancy, less aggressive tumours, lack of clinical trial evidence on treatment efficacy in older patients, and increased adverse effects of treatment. How-

Table 2: Trend in breast cancer relative survival by time since diagnosis and calendar period of follow-up, adults (age 15-99 years) diagnosed 1980-2008 with follow-up through 2009. Cases from all six registries pooled.

Year since Diagnosis	Calendar period					
	1995 – 1999 Total cases: 6048			2005 – 2009 Total cases: 6090		
	Deaths	Relative survival (%)	95% CI	Deaths	Relative survival (%)	95% CI
1	279	96.2	95.6, 96.9	189	97.8	97.3, 98.4
2	261	92.3	91.4, 93.3	229	95.3	94.6, 96.0
3	250	88.1	86.9, 89.2	244	92.5	91.6, 93.3
5	171	80.9	79.4, 82.4	176	87.8	86.7, 89.0
10	79	68.5	66.4, 70.7	121	77.7	76.1, 79.4

ever, these reasons can only explain a small portion of under-treatment among older breast cancer patients.¹⁷

According to the last published survival data from the EUROCORE-4 Study (a European partnership project with the aim to analyse cancer survival in European countries 1988-2002), Switzerland was among the countries with the highest relative breast cancer survival. However, survival in other countries improved more quickly than in Switzerland, with the effect that better relative survival is now observed in northern European nations.^{12,13} In 2012, survival data from the EUROCORE-5 Study will be available, allowing updated comparisons of Swiss cancer survival with the other European countries.

Population-based analysis of high-resolution data not only support, but are necessary in order to better analyse and understand factors influencing incidence and survival of cancer. Survival after diagnosis of cancer is one of the major outcome measures and key criteria for assessing quality of cancer control related to both preventive (early detection) and therapeutic care. This study provides the most up-to-date breast cancer survival data with follow-up through 2009 currently available in Switzerland. The pooled data come from six cancer registries covering highly urbanized populations as well as mountain and rural regions of Switzerland; thus representing part of the heterogeneity of the Swiss population.

In conclusion, the current study shows an increasing trend breast cancer survival that levelled off in more recent years. However, low survival rates persisted in older women underscoring the urgent need for more rigorous care to avoid preventable death potentially related to age-specific under-treatment. This issue will become even more important as Switzerland's population continues to age and life expectancy increases.

References

1. Cancer in Switzerland. Situation and Development from 1983 up to 2007. Publisher: Federal Statistical Office (FSO), Foundation National Institute for Cancer Epidemiology and Registration (NICER), Swiss Childhood Cancer Registry (SKKR). Ordering Nr. 1177-1000.
2. Lorez M, Bordoni A, Bouchardy C, Ess S, Frick H and Konzelmann I (2012). Completeness of case ascertainment in Swiss cancer registration. in preparation.
3. Berkson and Gage (1950). Calculation of survival rates for cancer. *Proc Mayo Clinic*, 25, 270-286.
4. Ederer F, Axtell LM and Cutler SJ (1961). The relative survival: a statistical methodology. *Natl Cancer Inst Monogr*, 6, 101-121.
5. Hakulinen T (1982). Cancer survival corrected for heterogeneity in patient withdrawal. *Biometrics*, 38, 933-942
6. Elandt-Johnson RC and Johnson NL (1980). *Survival Models and Data Analysis*, New York: John Wiley & Sons.
7. Brenner H and Gefeller O (1996). An alternative approach to monitoring cancer patient survival. *Cancer*, 78, 2004-2010.
8. Brenner H, Gefeller O and Hakulinen T (2004). Period analysis for up-to-date cancer survival data: theory, empirical evaluation, computational realisation and applications. *Eur J Cancer*, 40, 326-335.

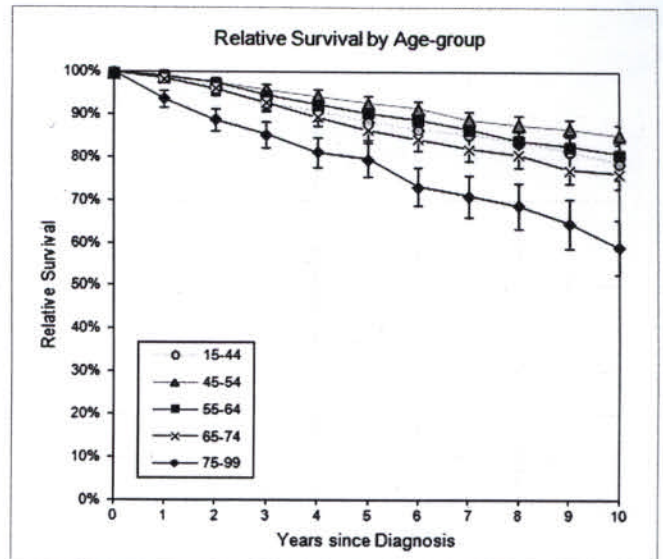


Figure 3. Age-specific breast cancer relative survival rates with 95% confidence intervals in the calendar period 2005-2009 for all six registries pooled.

9. Data Analysis and Statistical Software (STATA) (2007). Version 10. College Station, TX, StataCorp LP
10. Statistical Analysis System (SAS) (2006). Version 9.1. Cary, NC, SAS Institute.
11. Cox DR and Oakes D (1984). *Analysis of survival data*. New York: Chapman and Hall.
12. Brenner H, Francisci S, de Angelis R, Marcos-Gragera R, Verdecchia A, Gatta G, Allemani C, Ciccolallo L, Coleman M, Sant M; EUROCORE Working Group (2009). Long-term survival expectations of cancer patients in Europe in 2000-2002. *Eur J Cancer*, 45(6), 1028-41.
13. Sant M, Allemani C, Santaquilani M, Knijn A, Marchesi F, Capocaccia R; EUROCORE Working Group (2009). EUROCORE-4. Survival of cancer patients diagnosed in 1995-1999. Results and commentary. *Eur J Cancer*, 45(6), 931-91.
14. Bordoni A, Probst-Hensch NM, Mazzucchelli L, Spitala A (2009). Assessment of breast cancer opportunistic screening by clinical-pathological indicators: a population-based study. *Br J Cancer*, 101(11), 1925-31.
15. Ess S, Joerger M, Frick H, Probst-Hensch N, Vlastos G, Rageth C, Lütolf U, Savidan A and Thürlimann B (2011). Predictors of state-of-the-art management of early breast cancer in Switzerland. *Ann Oncol*, 22(3), 618-24.
16. Quaglia A, Tavilla A, Shack L, Brenner H, Janssen-Heijnen M, Allemani C, Colonna M, Grande E, Grosclaude P, Vercelli M; EUROCORE Working Group (2009). The cancer survival gap between elderly and middle-aged patients in Europe is widening. *Eur J Cancer*, 45(6), 1006-16.
17. Bouchardy C, Rapiti E, Blagojevic S, Vlastos AT, Vlastos G (2007). Older female cancer patients: importance, causes, and consequences of undertreatment. *J Clin Oncol*, 25(14), 1858-69.

Correspondence:

Matthias Lorez, PhD, Biostatistician
National Institute for Cancer Epidemiology
and Registration (NICER)
University of Zürich, Seilergraben 49
CH-8001 Zürich
mattias.lorenz@nicer.org