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Original article

Trends in survival for patients diagnosed with cancer in Vaud, Switzerland, between 1974 and 1993

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Summary

Background: Analysis of trends in cancer survival in defined well surveilled populations can provide useful indications on advancements in cancer management and treatment.

Patients and methods: Survival rates from the Vaud Cancer Registry were computed for 31,158 cases registered in 1984–1993, and compared with those registered in 1974–1978 and 1979–1983.

Results: A systematic, albeit generally moderate, tendency towards increasing five-year relative survival was observed for both sexes and most major cancer sites, including oral cavity and pharynx (0.38–0.43), stomach (0.21–0.26), colon (0.49–0.55), rectum (0.45–0.51), lung (0.08–0.12), skin melanoma (0.67–0.89), female breast (0.67–0.80), endometrium (0.72–0.84), ovary (0.28–0.37). prostate (0.44–0.66), testis (0.73–0.96), bladder (0.31–0.50), kidney and renal pelvis (0.41–0.59), thyroid (0.73–0.81), non-Hodgkin's lymphomas (0.37–0.63), Hodgkin's disease (0.61–0.81), and leukaemias (0.27–0.39). Survival for all cancers and both sexes combined, rose from 0.51–0.64 (0.57 for males, 0.71 for females). No appreciable change in survival was observed for cancers of oesophagus, liver, gallbladder, pancreas, larynx, cervix uteri, brain, multiple myeloma, as well as unidentified or unknown origin neoplasms.

Conclusions: Survival estimates for most cancer sites are comparable to the US SEER dataset, and their pattern of trends are discussed in terms of improved diagnosis and treatment for various neoplasms.

Key words: cancer registry, neoplasms, population-based, survival, Switzerland, time trends

Introduction

Analysis of trends in cancer survival in a specific, well surveilled population can provide useful indications on advancements in cancer management and treatment. We have analyzed survival for patients diagnosed with cancer in the Swiss Canton of Vaud in the periods 1974–1978 and 1979–1983, showing only modest advancements in survival for most cancer sites [1].

Over the last few years, cancer survival estimates have been made available from the SEER Program of the US National cancer Institute [2–4], the Finnish Cancer Registry [5], as well as from the EUROCARE project [6], which includes a network of European cancer registration areas. These showed generally higher survival rates from North America and substantial variations within Europe, in the absence of a clear interpretation [7].

It is therefore interesting to re-consider patterns and trends in cancer survival from well defined and uniformly followed – over long time periods – populations. In the present report, we update cancer survival figures from the Vaud Cancer Registry, including patients diagnosed in the calendar periods 1984–1988 and 1989–1993.

Patients and methods

The data considered for this analysis were abstracted from the Vaud Cancer Registry datafile, which includes data concerning incident cases of malignant, and selected benign or borderline, neoplasms diagnosed in the resident population of the Canton (whose population in 1990 was about 602,000 inhabitants [8, 9]). Information systematically collected by the registry includes general demographic characteristics of the patient (age, sex, municipality of residence), site and histological type of the tumour according to the standard International Classification of Diseases for Oncology (ICD-O) [10]), and time of registration. A total of 53,203 invasive cancer cases registered between 1974 and 1993 were included in the present study, after exclusion of 2,475 cases either registered on death certificates alone (2.1% in the Vaud Cancer registry datafile) [8, 9] or detected at death (2.3%). Table 1 gives the distribution of cases considered according to cancer site (and corresponding ICD-O), sex and the two most recent quinquennial incidence calendar periods considered.

Information on survival was derived from mortality statistics and, for 'apparently' non deceased cases, through an active follow-up based on verification of vital status from registries of current residence. The vital status of each registered case has thus been verified up to December 31, 1998. Information on tumour stage was not available in the global cancer registry dataset.

Survival curves were defined according to the product limit (maximum likelihood. Kaplan and Meier) method [11] for four subsequent calendar periods (i.e., 1974–1978, 1979–1983, 1984–1988, 1989–1993). sex and age group (<60 and $\geqslant 60$ years at diagnosis), and

Table I. Distribution of cases[a] according to cancer site (and corresponding ICD), sex and calendar period.

Cancer site	ICD	Number of cases			
		Males		Females	
		1984–1988	1989–1993	1984–1988	1989–1993
Mouth or pharynx	140–9	396	428	79	127
Oesophagus	150	155	184	52	69
Stomach	151	242	220	141	126
Colon	153	413	481	453	457
Rectum	154	268	273	243	246
Liver	155	99	138	29	33
Gallbladder and biliary tract	156	47	46	80	77
Pancreas	157	166	182	166	185
Larynx	161	140	120	15	20
Trachea, bronchus and lung	162	1114	1189	236	307
Bone	170	13	19	9	5
Connective tissue	171	32	37	37	43
Melanomatous skin cancer	172	177	231	212	288
Non-melanomatous skin cancer	173	1855	2341	1745	2320
Breast (females)	174	–	–	1629	2017
Cervix uteri	180	–	–	160	154
Corpus uteri	182	–	–	279	320
Ovary	183	–	–	238	240
Prostate	185	833	1166	–	–
Testis	186	120	142	–	–
Bladder	188	306	340	95	107
Kidney and renal pelvis	189.0–0.1	151	188	105	123
Brain	191	88	93	76	83
Thyroid	193	20	24	73	87
Non-Hodgkin lymphomas	200, 202	229	299	175	239
Hodgkin's disease	201	35	37	33	29
Multiple myeloma	203	77	61	58	76
Leukaemia	204–8	142	143	121	112
Childhood leukaemia (< 15 years)	204–8	9	10	10	8
Unknown origin	195, 199	172	169	151	155
Total, all cancers	140–208	7411	8710	6817	8220

[a] Only invasive tumours considered.
Results from Vaud Cancer Registry, Switzerland, 1984–1993.

differences between survival curves for the first and the last calendar period were tested by means of the usual log-rank test [12, 13]. Five-year survival was computed starting from the date of confirmation (mostly histological verification) of the diagnosis. Relative survival rates [14] were computed, after allowance for the general lifetables of the canton [1].

Results

Table 2 gives the five-year crude survival rates – and corresponding standard errors – from each cancer site and sex diagnosed in the last two subsequent incidence periods considered (1984–1988 and 1989–1993).

Table 3 gives five-year relative survival rates for each cancer site and sex in 1974–1978, 1984–1988 and 1989–1993. A systematic, albeit moderate, tendency towards increasing survival was observed for both sexes and most major cancer sites, including oral cavity and pharynx (0.38–0.43), stomach (0.21–0.26), colon (0.49–0.55), rectum (0.45–0.51), lung (0.08–0.12), skin melanoma (from 0.67 to 0.89), female breast (0.67–0.80), endometrium (0.72–0.84), ovary (0.28–0.37), prostate (0.44–0.66), testis (0.73–0.96), bladder (0.31–0.50), kidney and renal pelvis (0.41–0.59), thyroid (0.73–0.81), non-Hodgkin's lymphomas (0.37–0.63), Hodgkin's disease (0.61–0.81), and leukaemias (0.27–0.39). Survival for all cancers and both sexes combined rose from 0.51 to 0.64 (0.57 for males, 0.71 for females). Excluding non-melanomatous skin cancer, corresponding values rose from 0.31 to 0.43 for males, from 0.51 to 0.60 for females, and from 0.41 to 0.51 for both sexes combined. The changes observed in total cancer survival, however, also reflect the different composition of cancer sites over time (i.e., a relative decline in lung cancer and a rise in prostate cancer in males; the decline in stomach but the proportional rise in colorectal cancer). For a few common cancer sites (e.g., stomach, prostate, cervix uteri and ovary) survival increases were observed between 1984–1988 and 1989–1993, after 15 years of substantial stability or very modest improvement.

No appreciable change in survival, however, was observed for several upper digestive tract sites, including cancers of oesophagus (five-year relative survival rate in

Table 2. Five-year product-limit crude survival rates from various cancers according to sex and calendar period.

Cancer site	Males		Females		Total	
	1984–1988	1989–1993	1984–1988	1989–1993	1984–1988	1989–1993
Mouth or pharynx	0.34 (0.02)	0.37 (0.02)	0.44 (0.06)	0.42 (0.04)	0.36 (0.02)	0.38 (0.02)
Oesophagus	0.05 (0.02)	0.08 (0.02)	0.15 (0.05)	0.06 (0.03)[a]	0.07 (0.02)	0.07 (0 02)
Stomach	0.15 (0.02)	0.21 (0.03)	0.15 (0.03)	0.19 (0.03)	0.15 (0.02)	0.20 (0 02)[b]
Colon	0.39 (0.02)	0.41 (0.02)[b]	0.40 (0.02)	0.45 (0.02)	0.40 (0.02)	0.43 (0.02)[b]
Rectum	0.35 (0.03)	0 40 (0.03)[b]	0.38 (0.03)	0.42 (0.03)[b]	0.37 (0.02)	0.41 (0.02)[c]
Liver	0.02 (0.01)[a]	0.07 (0.02)[a]	–	0.06 (0.04)[a]	0.02 (0.01)[a]	0.06 (0.02)
Gallbladder and biliary tract	0.09 (0.04)[a]	0.07 (0.04)[a]	0.12 (0.04)	0.10 (0.03)	0.10 (0.03)	0.09 (0.03)
Pancreas	0.01 (0.01)[a]	0 03 (0.01)[a]	0.01 (0.01)[a]	0.03 (0.01)[a]	0.01 (0.01)[a]	0.03 (0.01)
Larynx	0.67 (0.04)	0.49 (0.05)[c]	0.47 (0.13)	0.90 (0.17)[c]	0.65 (0.04)	0.55 (0.04)
Trachea, bronchus and lung	0.09 (0.01)	0.11 (0.01)	0.12 (0.02)	0.11 (0.02)	0.10 (0.01)	0.11 (0.01)
Bone	0.62 (0.13)	0 47 (0.11)	0.67 (0.16)	0.80 (0.18)[a]	0.64 (0.10)	0.54 (0.10)
Connective tissue	0.70 (0.08)	0.55 (0.08)	0.59 (0.08)	0.46 (0.08)	0.64 (0.06)	0.50 (0.06)[b]
Melanomatous skin cancer	0.64 (0.04)	0.70 (0.03)[c]	0.79 (0.03)	0.87 (0.02)[c]	0.72 (0.02)	0.79 (0.02)[c]
Non-melanomatous skin cancer	0.75 (0.01)	0.76 (0.01)[b]	0.82 (0.01)	0.82 (0.01)	0.78 (0.01)	0.79 (0.01)[b]
Breast (females)	–	–	0.69 (0.01)	0.72 (0.01)[c]	–	
Cervix uteri	–	–	0.55 (0.04)	0.62 (0.04)	–	–
Corpus uteri	–	–	0.69 (0.03)	0.74 (0.02)	–	–
Ovary	–	–	0.28 (0.03)	0.32 (0.03)	–	–
Prostate	0 34 (0.02)	0.47 (0.01)[c]	–	–	–	–
Testis	0.87 (0.03)	0.94 (0.02)[c]	–	–	–	–
Bladder	0 38 (0.03)	0.39 (0.03)	0 35 (0.05)	0.37 (0.05)	0.37 (0.02)	0.38 (0.02)
Kidney and renal pelvis	0.36 (0.04)	0.53 (0.04)[c]	0.41 (0.05)	0.41 (0.04)	0.38 (0.03)	0.48 (0.03)[b]
Brain	0.28 (0.05)	0.19 (0.04)	0.20 (0.05)	0.13 (0.04)	0.24 (0.03)	0.15 (0.03)
Thyroid	0.80 (0.09)	0.62 (0.10)	0.89 (0.04)	0.75 (0.05)[c]	0.87 (0.04)	0.72 (0.04)[c]
Non-Hodgkin lymphomas	0.45 (0.03)	0.51 (0.03)	0.52 (0.04)	0.54 (0.03)	0.48 (0.03)	0.53 (0.02)[c]
Hodgkin's disease	0.77 (0.07)	0.76 (0.07)[c]	0 72 (0.08)	0.83 (0.07)	0.74 (0.05)	0.79 (0.05)
Multiple myeloma	0.22 (0.05)	0.28 (0.06)	0.40 (0.06)	0.24 (0.05)	0.28 (0.04)	0.26 (0.04)
Leukaemia	0.31 (0.04)	0.35 (0.04)	0 35 (0.04)	0.30 (0.04)	0.33 (0.03)	0.33 (0.03)
Childhood leukaemia (< 15 years)	0.65 (0.17)[a]	0.80 (0.13)	0.80 (0.13)	0.75 (0.15)	0.73 (0.10)	0.78 (0.10)
Unknown origin	0.05 (0.02)	0.07 (0.02)	0.08 (0.02)	0.07 (0.02)	0.06 (0.01)	0.07 (0.01)
Total, all cancers	0.41 (0.01)	0.46 (0.01)[c]	0.57 (0.01)	0.61 (0.01)[c]	0.48 (0.00)	0.53 (0.00)[c]
Total, skin non-melanoma excluded	0.30 (0.01)	0.34 (0.01)[c]	0.48 (0.01)	0.51 (0.01)[c]	0.38 (0.00)	0.43 (0.00)[c]

Standard error given within parentheses.
[a] Estimates based on less than five cases at the beginning of the interval; [b] $P < 0.10$; [c] $P < 0.05$.
Results from Vaud Cancer Registry, Switzerland, 1984–1993.

1989–1993: 0.09), larynx (0.64), as well as liver (0.08), gallbladder (0.11), pancreas (0.04), cervix uteri (0.70), brain (0.18), multiple myeloma (0.32), and unidentified or unknown origin neoplasms (0.09).

Table 4 gives corresponding figures for two separate age groups (< 60 and ⩾ 60 years). The tendency towards improved survival for several cancer sites was observed both before age 60 and at age 60 or over, although for some neoplasms (including breast, ovary, prostate and testis), it was apparently more marked in the younger age group. For kidney and bladder cancer, however, improvements in survival were observed, mostly in males, both at younger and at elderly age. The differences were larger for lymphoid neoplasms, including non-Hodgkin's lymphomas (0.48–0.78 under age 60, 0.28–0.52 at age ⩾ 60), Hodgkin's disease (0.68–0.85 under age 60; 0.24–0.45 at age ⩾ 60), and leukaemias (0.29–0.50 under age 60; 0.26–0.31 at age ⩾ 60). Survival for all cancers combined, except non-melanomatous skin cancer, increased from 0.50 to 0.62 under age 60, and from 0.35 to 0.45 at age ⩾ 60.

Figure 1 gives curves for the first (1974–1978) and the last (1989–1993) incidence period for eight selected sites, i.e., colon, lung, cutaneous melanoma, breast (females), ovary, prostate, testis and Hodgkin's disease. Statistically significant improvement in survival across the calendar period considered emerged for all these sites according to the log-rank test.

Discussion

The present estimates, derived from a carefully followed population and a structured network of data collection, indicate that five-year survival has apparently increased over the last two decades for several neoplasms in the Vaud population, although the interpretations of these findings are not obvious. Most trends of increased survival were steady over time, although the pattern for any specific neoplasms may be influenced by random variation.

Diagnostic anticipation has almost certainly had some role for cancers of the colorectum, prostate, breast and melanoma, following the introduction of PSA

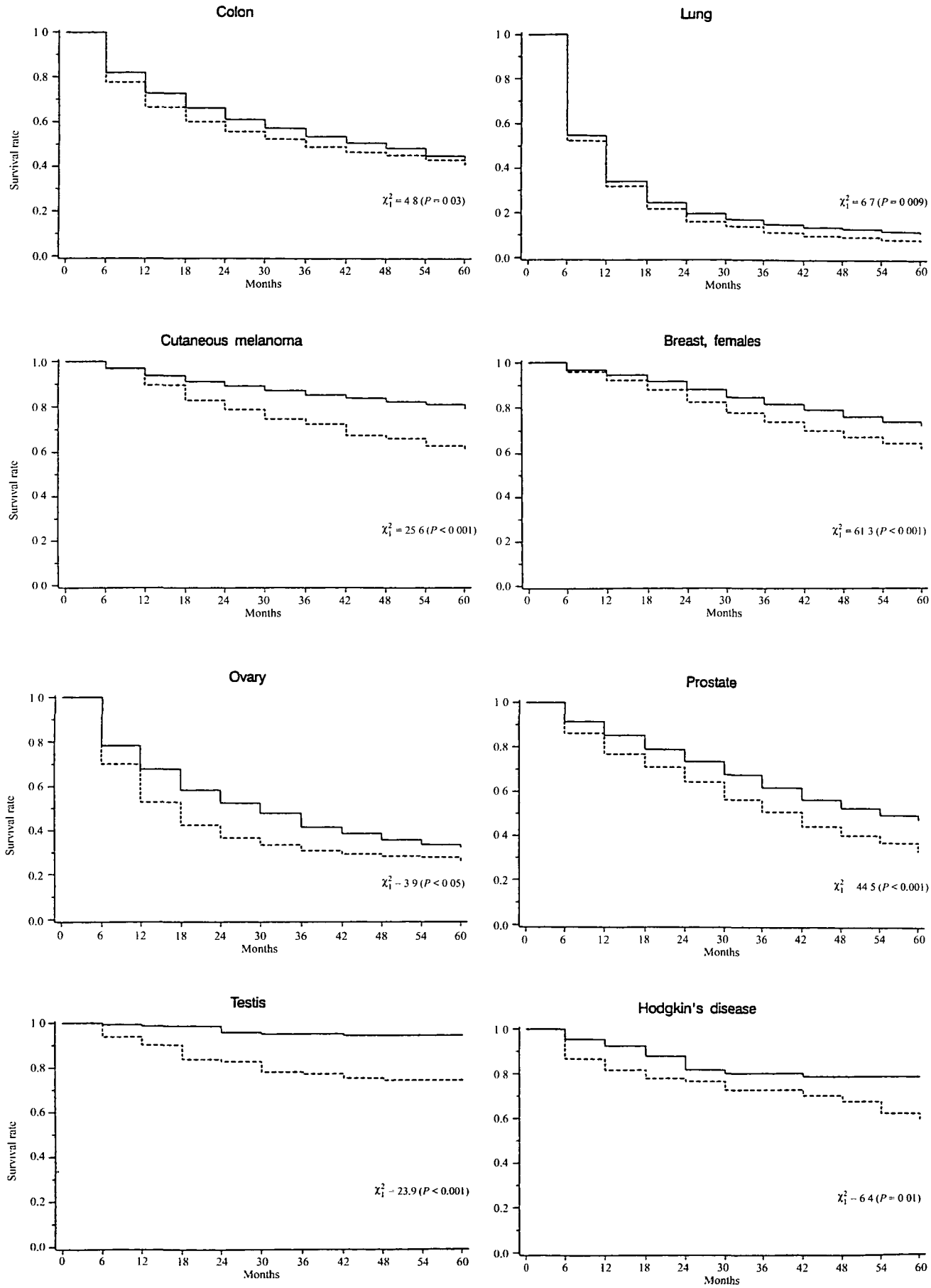

Figure 1. Survival curves for selected cancer sites according to calendar period of incidence (1974–1978 *versus* 1989–1993). Incident cases from the Vaud Cancer Registry, Switzerland, 1974–1993 (period 1974–1978: - - - -; period 1989–1993: ——).

Table 3. Five-year relative survival rates from various cancers according to sex and calendar period.

Cancer site	Males			Females			Total		
	1974–1978	1984–1988	1989–1993	1974–1978	1984–1988	1989–1993	1974–1978	1984–1988	1989–1993
Mouth or pharynx	0.35	0.39	0.42	0.50	0.50	0.48	0.38	0.41	0.43
Oesophagus	0.08	0.06	0.10	0.06	0.18	0.08[b]	0.07	0.09	0.09
Stomach	0.20	0.20	0.27	0.23	0.14	0.24	0.21	0.19	0.26
Colon	0.48	0.51	0.53	0.49	0.50	0.57	0.49	0.51	0.55
Rectum	0.39	0.45	0.51	0.52	0.47	0.51	0 45	0.46	0.51
Liver	NA[a]	0.03[b]	0.08	0.22[b]	NA	0.07[b]	0 05[b]	0.02[b]	0.08
Gallbladder and biliary tract	0.15	0.11[b]	0.08[b]	0.15	0.15	0.13	0.15	0.13	0.11
Pancreas	0.04	0.01[b]	0.04[b]	0.04	0.01[b]	0.04[b]	0.04	0.01[b]	0.04
Larynx	0 66	0.78	0.57	0.70	0.52	1.00	0.67	0.75	0.64
Trachea, bronchus and lung	0.08	0.11	0.12	0.10	0.13	0.12	0.08	0.11	0.12
Bone	0 45	0.67	0.53	0.79	0 72	0.86[b]	0.57	0.69	0.60
Connective tissue	0.54	0.74	0.64	0.72	0.63	0.55	0.66	0.68	0.59
Melanomatous skin cancer	0 61	0.75	0.81	0.71	0.87	0.94	0.67	0.82	0.89
Non-melanomatous skin cancer	0.94	0.95	0.97	0.96	0.98	0.99	0.95	0.96	0.98
Breast (females)	–	–	–	0.67	0.77	0.80	–	–	–
Cervix uteri	–	–	–	0.65	0.61	0.70	–	–	–
Corpus uteri	–	–	–	0.72	0.78	0.84	–	–	–
Ovary	–	–	–	0.28	0.32	0.37	–	–	–
Prostate	0 44	0.49	0.66	–	–	–	–	–	–
Testis	0.73	0 90	0.96	–	–	–	–	–	–
Bladder	0.31	0.50	0.51	0.30	0.44	0.47	0.31	0.48	0.50
Kidney and renal pelvis	0 42	0.43	0.66	0.39	0.47	0.48	0.41	0.45	0 59
Brain	0.23	0.30	0.22	0.20	0.21	0 14	0.21	0.26	0.18
Thyroid	0 68	0.88	0.70	0.75	0.97	0.85	0.73	0.95	0.81
Non-Hodgkin lymphomas	0.40	0.55	0.61	0.34	0.62	0.64	0.37	0.58	0.63
Hodgkin's disease	0.55	0.80	0.79	0.71	0.76	0.84	0.61	0.78	0.81
Multiple myeloma	0.25	0.28	0.37	0.40	0.42	0.29	0.32	0.35	0.32
Leukaemia	0.25	0.37	0.42	0.30	0.41	0.36	0.27	0.39	0.39
Childhood leukaemia (< 15 years)	0.36	0.65[b]	0.80	0.38	0.80	0.75	0.36	0.73	0.78
Unknown origin	0.18	0.07	0.09	0.14	0.09	0.08	0.16	0.08	0.09
Total, all cancers	0.43	0.51	0.57	0.59	0.66	0.71	0.51	0.59	0.64
Total, skin non-melanoma excluded	0.31	0.36	0.43	0.51	0.56	0.60	0.41	0.46	0.51

[a] Probability not assessable.
[b] Estimates based on less than five cases at the beginning of the interval.
Results from Vaud Cancer Registry, Switzerland, 1974–1993.

(prostate-specific antigen), mammography, occult blood tests and sigmoidoscopy, and a general increased awareness towards early diagnosis of these neoplasms, even in the absence of generalized standardized screening programs on a population level.

Earlier diagnosis – or changed diagnostic modalities – have probably influenced the registered survival for cancers of the kidney and bladder, too, since the treatment for these neoplasms, and the corresponding mortality rates [15, 16], have not substantially changed over time. This includes more accurate definition of invasion for bladder cancer, and more extensive use of abdominal CT scan and echography in the diagnosis of kidney cancer. Changed definition of the disease, with the inclusion of early disease may have favourably influenced trends in survival for skin melanoma [17] and lymphomas [18], too.

Advancements in treatment partly or largely account for the improved survival of testicular cancer [19, 20], leukaemias in childhood, yound and middle age up to age 60 [21–24], as well as lymphomas [20], and may have had some impact on breast [25–27] and perhaps ovarian [28] cancer survival, too. Thus, for breast cancer appreciable improvements in survival have been observed over the last few years through screening and improved diagnosis [29], as well as improved treatment, including essentially adjuvant treatment for early stage breast cancer, both node negative and positive [25, 26, 30].

However, it is more difficult to explain, through improved diagnosis and earlier detection, as well as through therapeutic advancements, the increased survival estimates observed for stomach, colorectal, as well as for lung cancer, although some impact of earlier diagnosis may have been observed for these neoplasms, too [31, 32]. For most of these neoplasms, in any case, there is little basis for suggesting a substantial advancement in treatment. It is in any case not possible to provide, for any single neoplasm, a quantification of the potential impact of changed diagnosis and treatment on long-term survival. Survival, however, remains unfavourable for several cancer sites, including oesophagus, liver, pancreas and brain.

The rise in relative survival estimates over a five-year calendar period of 6 to 8% in this Swiss population was

Table 4. Five-year relative survival rates from various cancers according to age at diagnosis and calendar period

Cancer site	Age group					
	< 60 years			⩾ 60 years		
	1974–1978	1984–1988	1989–1993	1974–1978	1984–1988	1989–1993
Mouth or pharynx	0.46	0.40	0.46	0 31	0.41	0.41
Oesophagus	0.07	0.16	0.13	0.07	0.05	0.07
Stomach	0.34	0.28	0.38	0.18	0.17	0.22
Colon	0.61	0.59	0.63	0.45	0.48	0.53
Rectum	0.55	0.56	0.54	0.42	0.44	0.50
Liver	0.10	0.04	0.21	0.03	0.13	0.04
Gallbladder and biliary tract	0.24	0.28	0.18	0.13	0 11	0.10
Pancreas	0.06	0 04	0.09	0.03	0.00	0.02
Larynx	0.69	0.73	0.64	0.65	0.77	0.63
Trachea, bronchus and lung	0.13	0.10	0.18	0.06	0.11	0.10
Bone	0.62	0 71	0.54	0.30	0.58	0.78
Connective tissue	0.55	0.71	0.50	0.73	0.64	0.72
Melanomatous skin cancer	0.72	0.83	0.93	0.60	0.80	0.83
Non-melanomatous skin cancer	0.97	0.97	0.97	0.94	0.97	0.99
Breast (females)	0.67	0.75	0.83	0.67	0.79	0.78
Cervix uteri	0.74	0.73	0.76	0.52	0.52	0 63
Corpus uteri	0.83	0 87	0.92	0.64	0.74	0.11
Ovary	0.37	0.50	0.58	0.19	0.24	0 25
Prostate	0.39	0.69	0.71	0.44	0.48	0.66
Testis	0.74	0.91	0.96	0.63	0.58	NA[a]
Bladder	0.39	0.64	0.57	0 28	0.44	0.48
Kidney and renal pelvis	0.49	0.61	0.64	0.36	0.38	0.56
Brain	0.29	0.40	0 29	0.10	0.02	0.02
Thyroid	0.91	0.98	0.94	0.50	0.88	0.55
Non-Hodgkin lymphomas	0.48	0 72	0.78	0.28	0.49	0.52
Hodgkin's disease	0.68	0.88	0.85	0.24	0.30	0.45
Multiple myeloma	0.57	0.49	0.60	0.24	0.29	0.25
Leukaemia	0.29	0.52	0.50	0.26	0.30	0.31
Unknown origin	0.22	0.15	0.16	0.14	0.06	0.07
Total, all cancers	0.57	0.66	0.71	0.47	0.55	0.61
Total, skin non-melanoma excluded	0.50	0.57	0.62	0.35	0.40	0 45

[a] Probability not assessable.
Results from Vaud Cancer Registry, Switzerland, 1974–1993.

apparently greater than the 3% registered in England and Wales between cancers registered in 1981–1985 and those registered in 1986–1990 [33]. Any between country comparison, however, has to be taken with utmost caution, both for absolute rates and for trends over time, given the different standard and the variable changes in cancer diagnosis and registrations across various populations [7, 34]. These cautions notwithstanding, survival estimates for most cancer sites in this Swiss population are comparable to the US SEER dataset [4] and the most recent study from the Finnish cancer registration system [5], and similar or somewhat higher than those reported from European cancer registration systems [6], indicating that the standards of diagnosis and registration are satisfactory and comparatively elevated in this population.

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