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Trends in cancer incidence in Lithuania between 1991 and 2010

Ieva Vincerževskienė,

Agnė Krilavičiūtė,

Giedrė Smailytė

Lithuanian Cancer Registry,
Institute of Oncology,
Vilnius University

Background. Analysis of time trends in cancer incidence provides an estimate of the burden of cancer in a certain population and is a useful tool for planning cancer control. Identification of changing epidemiological patterns in cancer is crucial in formulating future healthcare clinical tools, evaluating prognostic and therapeutic models, and generating new hypotheses on disease aetiology and prevention.

Materials and methods. Patients diagnosed with cancer in Lithuania between 1991 and 2010 were considered into analysis. Crude rates and age-standardized incidence rates for both sexes were calculated, as well as annual percent change with 95% confidence intervals for selected cancer sites using the Joinpoint Regression Analysis.

Results. With the major exceptions of male lung cancer and stomach cancer in both sexes, cancer incidence has increased for most cancer sites in the last two decades in Lithuania. The strongest rises in incidence were seen for prostate cancer in men and thyroid cancer in women. Overall cancer incidence in men was strongly influenced by newly diagnosed prostate cancer cases.

Conclusions. This up-to-date analysis provides a basis for establishing priorities to cancer control actions in Lithuania. These results show increase in incidence rates in Lithuania of all cancers combined among both men and women. Trends in cancer incidence rates for males were heavily influenced by trends in prostate cancer which is the most common cancer among men. Increasing cancer incidence requires targeted interventions on risk factors control, early diagnosis, and improved management and pharmacological treatment for selected cancer sites.

Key words: cancer incidence, trends, annual percentage change

INTRODUCTION

Cancer control is a term that encompasses all elements of prevention, early detection, treatment, rehabilitation and palliation. The World Health Organization recommends that cancer control activities are best planned and delivered through a national cancer control plan, and notes that population-based cancer registries are a core component of cancer control strategy (1).

Information on cancer is available for analysis from individual cancer registries and from the

Corresponding author: Giedrė Smailytė, Lithuanian Cancer Registry, Institute of Oncology, Vilnius University, P. Baublio 3B, LT-08406 Vilnius, Lithuania. E-mail: giedre.smailyte@vuoi.lt

International Association of Cancer Registries. The Cancer Incidence in Five Continents series, started in the 1960s, bring together incidence data meeting acceptable quality criteria from population-based cancer registries throughout the world. The aim of the series is to make available data on cancer incidence for comparison from as wide a range of geographical locations as possible. This is the classical role of descriptive statistics: to allow formulation of hypotheses that might explain the observed differences (geographically, over time, in population subgroups) and that can be tested by further studies (2). Classically, such descriptive studies are said to be 'hypothesis generating' – providing clues to aetiology, to be followed up in studies that focus on specific risk factors (3).

Cancer registries are a vital source of information on cancer epidemiology and cancer services. The idea of recording information on all cancer cases in defined communities dates from the first half of the twentieth century. Originally, cancer registries were concerned with describing cancer patterns and trends, and later on, many were able to follow up the registered patients and calculate survival. In the last 20 years the role of registries has expanded further to embrace the planning and evaluation of cancer control activities, and the care of individual cancer patients (3).

The most basic function of a cancer registry in relation to cancer control is to assess the current magnitude of the cancer burden and its likely future evolution. Various statistics are available for assessing the "burden" of cancer, and of different types of cancer, in the population. Incidence is clearly a fundamental measure for this because it describes the stream of new cases that will require some kind of medical attention. It is the relevant measure when considering (primary) prevention the objective of which is to prevent disease occurrence. Measurement of incidence is the most basic function of population-based cancer registries (4).

In this paper, we present an analysis of long-term trends of cancer incidence in Lithuania using modern statistical methods of trend analysis. Analysis is based on data from the population-based Lithuanian Cancer Registry which contains data on the incidence of cancer in Lithuania since 1978.

MATERIALS AND METHODS

Cancer registry

The Lithuanian Cancer Registry is a population-based cancer registry which contains personal and demographic information (place of residence, sex, date of birth, vital status), as well as information on diagnosis (cancer site, date of diagnosis, method of cancer verification) and death (date of death, cause of death) of all cancer patients in Lithuania, where population size is around 3 million residents according to the 2011 census (5).

The national Cancer Registry was founded in 1984, but collection of the data on cancer incidence has already started in 1957. In 1993, the Lithuanian Cancer Registry became a full member of the International Association of Cancer Registries (IACR) in Lyon, France. Since the period 1988–1992, the Registry data have been included in 'Cancer Incidence in Five Continents' (6).

The principal sources of information on cancer cases are primary, secondary and tertiary health care institutions in the country that are responsible to fill in the notification when cancer is diagnosed. All physicians, all hospitals and other institutions in the country must send a notification to the Lithuanian Cancer Registry of all cancer cases that come to their attention. Some pathological laboratories send the respective laboratory notification automatically extracted from laboratory data systems, using a standard format. The notifications, supplemented by death certificate information, are built into a database suitable for statistical use. This database contains information on all cancer cases diagnosed in Lithuanian residents since 1978.

In the current analysis, patients diagnosed with cancer in 1991–2010 were considered. Cancers were classified according to the 9th (up to 1997) and the 10th (from 1998 onwards) editions of the International Classification of Diseases.

Statistical methods

We calculated crude rates (CRs) and age-adjusted incidence rates (ASRs) for four periods (1991–1995, 1996–2000, 2001–2005 and 2006–2010) by sex and cancer site. Adjustment for ASRs was done using the European standard population, where a total of 18 age groups were considered, each of 5-year bands starting from 0–4 years to 85 and older. Additionally, the annual percent change (APC) was

calculated for trends by means of the generalized linear model using the Joinpoint Software, Version 3.4.3 (7). The Joinpoint Regression Analysis allows identifying the best-fitting points ('joinpoints'), where a significant change in the linear slope (in a log scale) of the trend is detected. For each of the identified trends, we also fit a regression line to the natural logarithm of the rates using a calendar year as a regression variable. 95% confidence intervals for APC were calculated as well. Annual percent changes were considered statistically significant if $p < 0.05$.

RESULTS

The most common cancer sites for men and for women in the periods 1991–1995 and 2006–2010 are shown in Fig. 1. Among men, in 2006–2010 the most common cancers were prostate (34%), lung (14%), non-melanoma skin (8%), stomach (6%), rectum and anus, as well as colon (both 4%), while among women cancer of breast (18%), non-melanoma skin (16%), corpus uteri (7%) and cervix uteri (6%) comprised almost half of new diagnosis. The most striking changes in cancer incidence are seen in men, where number of prostate cancer cases dramatically rose from 8% in 1991–1995 to 34% in 2006–2010, as well as proportion of lung and stomach cancer dropped almost two times during the analysis time.

Number of cancer cases, crude and age-standardised incidence rates for selected cancer sites in four periods (from 1991–1995 to 2006–2010) are presented in Tables 1a and 1b, for men and women, respectively. In total, there was 260,659 primary cancer diagnosis (non-melanoma skin cancer

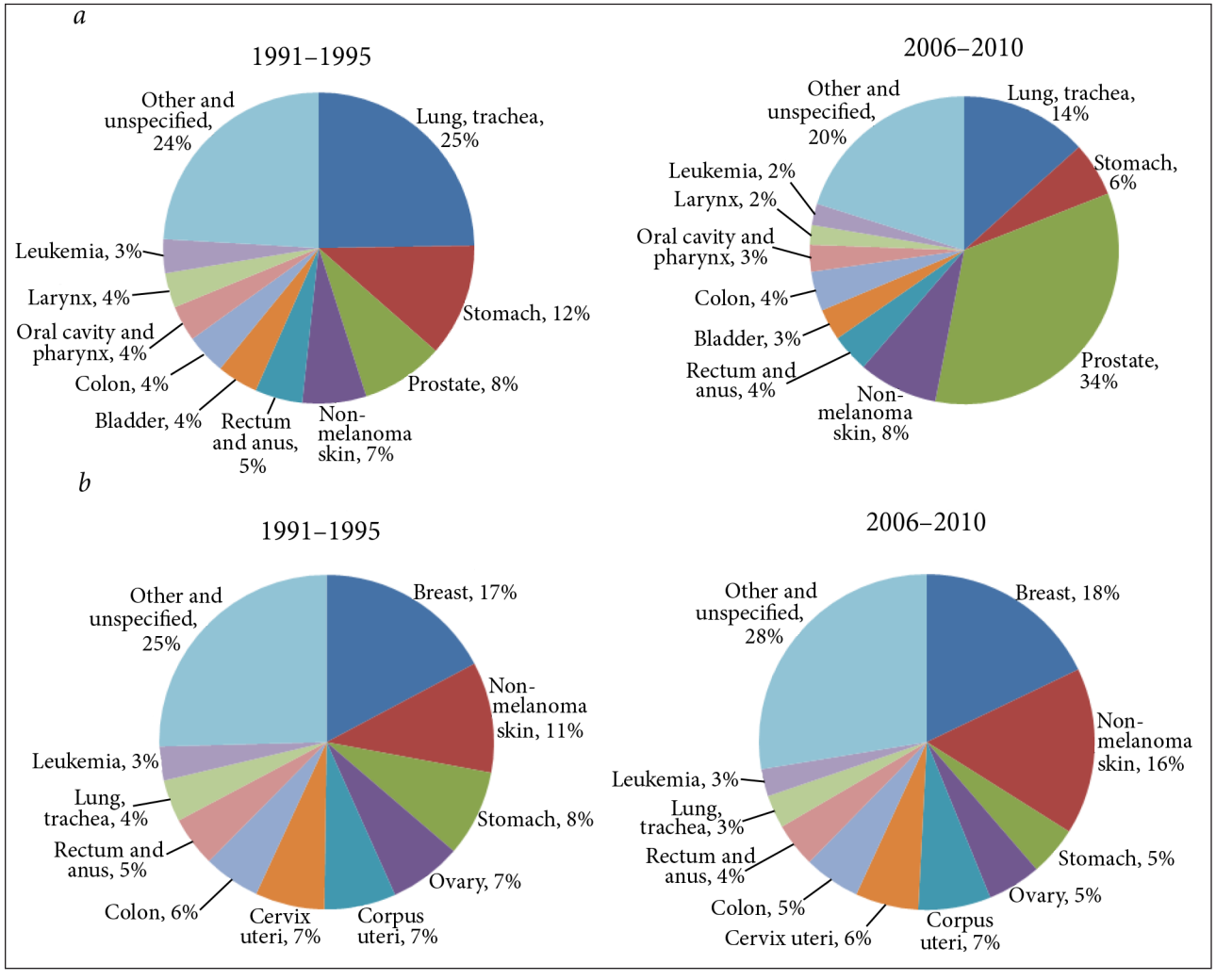

Fig. 1. The most common cancer sites in men (*a*) and in women (*b*) in 1991–1995 and 2006–2010

Table 1a. Number of cancer cases (N), crude (CR) and age-standardized incidence (ASR) rates in men, by cancer site between 1991–1995 and 2006–2010

Cancer site	ICD-10	1991–1995			1996–2000			2001–2005			2006–2010			1991–2010		
		N	CR	ASR	N	CR	ASR	N	CR	ASR	N	CR	ASR	N	CR	ASR
All sites but skin	C00-C96 (excl. C44)	27 649	317.8	387.0	30 459	364.3	418.0	36 022	447.1	471.3	44 261	567.6	568.1	138 391	420.4	463.0
All sites	C00-C96	29 610	340.3	414.9	33 421	399.7	459.5	39 493	490.1	517.1	48 257	618.8	619.2	150 781	458.1	504.9
Lip	C00	342	3.9	4.9	281	3.4	3.9	261	3.2	3.4	152	1.9	1.9	1 036	3.1	3.5
Oral cavity and pharynx	C01-C14	1 094	12.6	14.9	1 294	15.5	17.7	1 377	17.1	18.8	1 341	17.2	17.7	5 106	15.5	17.2
Stomach	C16	3 464	39.8	48.9	3 135	37.5	43.3	2 966	36.8	38.9	2 723	34.9	34.6	12 288	37.3	41.2
Colon	C18	1 235	14.2	17.6	1 478	17.7	20.5	1 778	22.1	23.1	1 983	25.4	25.0	6 474	19.7	21.7
Rectum and anus	C19-C21	1 457	16.7	20.7	1 690	20.2	23.4	1 872	23.2	24.4	1 913	24.5	24.4	6 932	21.1	23.3
Larynx	C32	1 065	12.2	14.6	983	11.8	13.4	922	11.4	12.4	984	12.6	12.9	3 954	12.0	13.3
Lung and trachea	C33, C34	7 301	83.9	102.0	6 923	82.8	94.3	6 743	83.7	88.0	6 398	82.0	82.1	27 365	83.1	91.7
Melanoma of skin	C43	268	3.1	3.6	340	4.1	4.5	432	5.4	5.6	516	6.6	6.6	1 556	4.7	5.1
Non-melanoma skin	C44	1 961	22.5	27.9	2 962	35.4	41.4	3 471	43.1	45.9	3 996	51.2	51.1	12 390	37.6	41.9
Prostate	C61	2 532	29.1	37.5	3 994	47.8	56.8	8 184	101.6	106.4	16 311	209.2	209.8	31 021	94.2	104.4
Testis	C62	140	1.6	1.6	190	2.3	2.2	170	2.1	2.0	220	2.8	2.6	720	2.2	2.1
Kidney	C64	870	10.0	12.1	1 467	17.5	19.9	1 820	22.6	23.9	2 012	25.8	26.0	6 169	18.7	20.6
Bladder	C67	1 260	14.5	18.2	1 640	19.6	22.8	1 804	22.4	23.8	1 583	20.3	20.2	6 287	19.1	21.2
Brain, nervous system	C70-C72	545	6.3	7.0	633	7.6	8.1	612	7.6	7.8	680	8.7	8.7	2 470	7.5	7.9
Thyroid	C73	120	1.4	1.5	120	1.4	1.6	224	2.8	2.9	262	3.4	3.3	726	2.2	2.3
Ill-defined	C76-C80	470	5.4	6.7	743	8.9	10.2	923	11.5	12.2	1 078	13.8	13.9	3 214	9.8	10.8
Hodgkin's lymphoma	C81	279	3.2	3.3	229	2.7	2.8	187	2.3	2.3	181	2.3	2.2	876	2.7	2.6
Non-Hodgkin's lymphoma	C82-C85	359	4.1	4.8	466	5.6	6.2	684	8.5	8.7	748	9.6	9.4	2 257	6.9	7.3
Multiple myeloma	C90	219	2.5	3.1	221	2.6	3.0	304	3.8	4.0	333	4.3	4.2	1 077	3.3	3.6
Leukemia	C91-C95	1 036	11.9	14.0	1 098	13.1	14.9	1 113	13.8	14.6	1 081	13.9	14.0	4 328	13.1	14.4

Table 1b. Number of cancer cases (N), crude (CR) and age-standardized incidence (ASR) rates in women, by cancer site between 1991–1995 and 2006–2010

Cancer site	ICD-10	1991–1995			1996–2000			2001–2005			2006–2010			1991–2010		
		N	CR	ASR	N	CR	ASR	N	CR	ASR	N	CR	ASR	N	CR	ASR
All sites but skin	C00-C96 (excl. C44)	25 789	265.4	240.8	29 489	312.0	267.5	32 287	351.1	281.2	34 703	387.5	293.0	122 268	327.6	270.8
All sites	C00-C96	28 878	297.2	268.0	34 600	366.0	310.9	38 115	414.4	327.0	41 344	461.6	342.7	142 937	383.0	312.6
Lip	C00	96	1.0	0.8	93	1.0	0.7	88	1.0	0.6	64	0.7	0.4	341	0.9	0.6
Oral cavity and pharynx	C01-C14	226	2.3	2.1	249	2.6	2.2	293	3.2	2.6	271	3.0	2.4	1 039	2.8	2.3
Stomach	C16	2 410	24.8	20.9	2 316	24.5	19.3	2 125	23.1	16.5	1 960	21.9	14.4	8 811	23.6	17.6
Colon	C18	1 582	16.3	13.9	1 820	19.3	15.4	2 046	22.2	16.0	2 244	25.1	16.4	7 692	20.6	15.5
Rectum and anus	C19-C21	1 399	14.4	12.4	1 501	15.9	12.5	1 645	17.9	12.7	1 760	19.7	13.3	6 305	16.9	12.7
Larynx	C32	52	0.5	0.5	55	0.6	0.5	46	0.5	0.4	53	0.6	0.5	206	0.6	0.5
Lung and trachea	C33, C34	1 171	12.1	10.2	1 222	12.9	10.0	1 297	14.1	10.0	1 319	14.7	9.9	5 009	13.4	10.0
Melanoma of skin	C43	547	5.6	5.3	705	7.5	6.8	720	7.8	6.7	892	10.0	7.7	2 864	7.7	6.6
Non-melanoma skin	C44	3 089	31.8	27.2	5 111	54.1	43.5	5 828	63.4	45.8	6 641	74.1	49.7	20 669	55.4	41.8
Breast	C50	4 972	51.2	49.2	6 107	64.6	59.2	6 511	70.8	60.4	7 394	82.6	67.3	24 984	66.9	59.0
Cervix uteri	C53	1 933	19.9	19.4	2 306	24.4	23.1	2 537	27.6	25.6	2 520	28.1	25.4	9 296	24.9	23.3
Corpus uteri	C54, C55	1 999	20.6	19.3	2 404	25.4	22.6	2 709	29.5	24.7	2 888	32.2	25.1	10 000	26.8	23.0
Ovary	C56	2 025	20.8	19.5	2 115	22.4	19.9	2 060	22.4	18.7	2 134	23.8	18.7	8 334	22.3	19.2
Kidney	C64	671	6.9	6.3	1 113	11.8	9.9	1 278	13.9	10.9	1 450	16.2	11.9	4 512	12.1	9.8
Bladder	C67	388	4.0	3.3	535	5.7	4.2	525	5.7	3.9	529	5.9	3.6	1 977	5.3	3.7
Brain, nervous system	C70-C72	539	5.5	5.4	570	6.0	5.7	632	6.9	6.0	785	8.8	7.0	2 526	6.8	6.1
Thyroid	C73	506	5.2	5.1	639	6.8	6.4	1 266	13.8	13.0	1 600	17.9	16.2	4 011	10.7	10.2
Ill-defined	C76-C80	400	4.1	3.5	580	6.1	4.8	825	9.0	6.3	965	10.8	6.8	2 770	7.4	5.5
Hodgkin's lymphoma	C81	281	2.9	2.9	266	2.8	2.7	233	2.5	2.4	198	2.2	2.1	978	2.6	2.5
Non-Hodgkin's lymphoma	C82-C85	329	3.4	3.1	456	4.8	4.1	770	8.4	6.4	863	9.6	6.8	2 418	6.5	5.2
Multiple myeloma	C90	277	2.9	2.6	325	3.4	2.7	447	4.9	3.6	439	4.9	3.4	1 488	4.0	3.1
Leukemia	C91-C95	947	9.7	8.6	1 004	10.6	8.8	1 067	11.6	9.1	1 086	12.1	9.1	4 104	11.0	8.8

excluded) during 20 years of analysis. Number of cancer cases rose more strongly in men than in women between 1991–1995 and 2006–2010, by 60.1 and 34.6%, respectively.

The ASR for all cancer sites but skin rose markedly from 387.0 in 1991–1995 to 568.1 per 100 000 in 2006–2010 in men, while the increase was big but less expressed in women, from 240.8 in 1991–2006 to 293.0 per 100 000 in 2006–2010. Among men, the strongest rise in ASR was for prostate cancer, where ASR in 1991–1995 was 37.5 and increased to 209.8 in 2006–2010. Big increase was observed for kidney cancer (+13.9 units) between these two periods as well, on the other hand, more than 10 units decrease in ASR was seen for lung and trachea (–19.9) and for stomach (–14.3) cancer. Among women, more than 2-fold rise in ASR was seen for thyroid cancer (+11.1 units). Breast cancer incidence rose by +18.1 units, while the biggest decrease in ASR among women was seen for stomach cancer (–6.5 units).

Annual percent change with 95% confidence intervals for selected cancer sites in the period 1991–2010 and in line segments selected by the Joinpoint Regression Analysis is shown in Tables 2a and 2b, for men and women, respectively. For all cancer sites combined (non-melanoma skin cancer excluded) incidence rate during the study period increased significantly for both sexes and was more expressed in men, where APC rose by 2.4 and 1.3% per year in men and in women, respectively. Cancer incidence during the study period increased significantly in 13 out of 20 cancer sites in men and in 12 out of 22 in women. The significant decrease in cancer incidence was observed only in 5 and 2 cancer sites for men and women, respectively.

The site-specific results of the Joinpoint Regression Analysis of cancer incidence in men showed continuous increase without any changes during 20 years for cancer of colon, rectum and anus, brain and nervous system and thyroid, as well as melanoma of skin, testicular cancer, non-Hodgkin's lymphoma and multiple myeloma. The most rapid increase in incidence was observed for prostate cancer, overall by +11.7% per year. Incidence rose by +22.5% between 2001 and 2007, but increase was seen before 2001 as well, by +8.1% per year. Strong decrease though not significant was seen for prostate cancer incidence from the year 2007. Continuous decrease in cancer incidence among men was observed for lung and stomach cancer, and for Hodgkin's lymphoma (all statistically significant).

Trends in cancer incidence among women had changed only for few cancer sites during the period of analysis, and these are cancers of kidney, bladder and thyroid, as well as cervical cancer. The incidence of cervical cancer levelled off in 2004, where increase by +2.9% per year was seen prior and slight insignificant decrease was seen afterwards. Overall, APC of thyroid cancer was the biggest among women (+8.5% per year), but statistical rise was seen just before 2000, afterwards increase was not meaningful.

Incidence of all cancers combined statistically increased among men from 1991 to 2007 and then meaningful decrease was observed. No such pattern was observed among women, where incidence of all cancers combined increased during all the observation period.

Age-standardised incidence rates and regression lines fitting these rates for selected cancers are demonstrated in Fig. 2. The strongest increase in cancer incidence is clearly visible for prostate cancer with the peak in 2007, and at the same time, increase for all cancers combined was observed among men. A small gap between age-standardised incidence rates of colon cancer between men and women was notable in 1991, and it became wider in 2010 with colon cancer being more common in men than in women.

DISCUSSION

We analysed trends in cancer incidence in Lithuania between 1991 and 2010 based on data from the population-based Lithuanian Cancer Registry and found an increase in cancer incidence for almost all cancer sites with a few exceptions in two decades for both sexes. Based on 2012 data, the estimated age-standardized incidence rate for all cancer sites combined is slightly higher for men in Lithuania than in Europe, while these estimates are very similar for women (8).

In the 90s, lung cancer was the most common cancer diagnosis among men in Lithuania. The incidence rate in Lithuanian men is quiet high and similar to those obtained in other Central and Eastern European countries (8–10). Decrease

Table 2a. Results of the Joinpoint Regression Analysis in cancer incidence trends by cancer site in men, 1991–2010

Cancer site	ICD-10	Number of joinpoints	Line segment		Annual percent change	95% confidence intervals	
			Start	End		Lower	Upper
All sites but skin	C00-C96 (excl. C44)	0	1991	2010	2.4*	2.0	2.9
		2	1991	2004	1.8*	1.4	2.2
			2004	2007	9.0*	1.5	17.1
			2007	2010	–4.7*	–8.1	–1.3
All sites	C00-C96	0	1991	2010	2.5*	2.1	2.9
		2	1991	2004	2.0*	1.7	2.4
			2004	2007	7.9*	1.2	15.1
			2007	2010	–3.6*	–6.7	–0.4
Lip	C00	0	1991	2010	–5.6*	–7.0	–4.2
		2	1991	2004	–3.1*	–5.0	–1.2
			2004	2007	–21.4	–45.9	14.2
			2007	2010	8.4	–10.0	30.7
Oral cavity and pharynx	C01-C14	0	1991	2010	1.2*	0.6	1.9
		1	1991	2000	3.3*	1.6	5.0
			2000	2010	–0.5	–1.9	0.9
Stomach	C16	0	1991	2010	–2.3*	–2.7	–1.9
Colon	C18	0	1991	2010	2.3*	1.8	2.8
Rectum and anus	C19-C21	0	1991	2010	1.0*	0.6	1.4
Larynx	C32	0	1991	2010	–0.8*	–1.4	–0.2
Lung and trachea	C33, C34	0	1991	2010	–1.5*	–1.7	–1.2
Melanoma of skin	C43	0	1991	2010	4.0*	2.9	5.0
Non-melanoma skin	C44	0	1991	2010	3.9*	3.1	4.8
		3	1991	1993	–3.2	–16.1	11.7
			1993	1997	13.3*	5.5	21.8
			1997	2007	1.2	–0.2	2.5
			2007	2010	8.0*	0.6	16.1
Prostate	C61	0	1991	2010	11.7*	10.0	13.4
		2	1991	2001	8.1*	6.0	10.3
			2001	2007	22.5*	15.7	29.8
			2007	2010	–11.0	–21.7	1.2
Testis	C62	0	1991	2010	3.0*	1.7	4.4
Kidney	C64		1991	2010	5.9*	3.9	8.0
		1	1991	1995	28.6*	11.8	47.9
			1995	2010	2.9*	1.0	4.9
Bladder	C67		1991	2010	0.8	–0.3	1.8
		2	1991	2001	4.8*	3.6	6.0
			2001	2007	–5.1*	–8.3	–1.9
			2007	2010	3.6	–3.7	11.7
Brain, nervous system	C70-C72	0	1991	2010	1.2*	0.5	1.8
Thyroid	C73	0	1991	2010	5.9*	4.4	7.6
Ill-defined	C76-C80	0	1991	2010	5.0*	3.9	6.0
		1	1991	1996	12.5*	6.0	19.5
			1996	2010	3.3*	2.1	4.6
Hodgkin's lymphoma	C81	0	1991	2010	–2.7*	–4.2	–1.1
Non-Hodgkin's lymphoma	C82-C85	0	1991	2010	5.1*	4.0	6.3
Multiple myeloma	C90	0	1991	2010	2.6*	1.4	3.9
Leukemia	C91-C95	0	1991	2010	–0.2	–1.0	0.5

* Annual percent change is statistically significant.

Table 2b. Results of the Joinpoint Regression Analysis in cancer incidence trends by cancer site in women, 1991–2010

Cancer site	ICD-10	Number of joinpoints	Line segment		Annual percent change	95% confidence intervals	
			Start	End		Lower	Upper
All sites but skin	C00-C96 (excl. C44)	0	1991	2010	1.3*	1.1	1.5
		1	1991	1999	2.0*	1.4	2.6
			1999	2010	0.8*	0.5	1.2
All sites	C00-C96	0	1991	2010	1.6*	1.3	1.9
		1	1991	1999	2.7*	2.0	3.5
			1999	2010	0.9*	0.4	1.3
Lip	C00	0	1991	2010	–4.8*	–7.3	–2.3
Oral cavity and pharynx	C01-C14	0	1991	2010	1.2	0.0	2.5
Stomach	C16	0	1991	2010	–2.5*	–3.0	–2.1
Colon	C18	0	1991	2010	1.2*	0.6	1.7
Rectum and anus	C19-C21	0	1991	2010	0.4	0.0	0.9
Larynx	C32	0	1991	2010	–1.5	–4.3	1.5
Lung and trachea	C33, C34	0	1991	2010	–0.2	–0.7	0.4
Melanoma of skin	C43	0	1991	2010	2.3*	1.6	3.0
Non-melanoma skin	C44	0	1991	2010	3.9*	2.8	4.9
Breast	C50	0	1991	2010	1.9*	1.5	2.3
Cervix uteri	C53	0	1991	2010	1.7*	1.1	2.1
		1	1991	2004	2.9*	1.9	3.8
			2004	2010	–1.6	–4.4	1.3
Corpus uteri	C54, C55	0	1991	2010	1.8*	1.2	2.3
Ovary	C56	0	1991	2010	–0.3	–0.9	0.3
Kidney	C64	0	1991	2010	4.7*	2.9	6.5
		1	1991	1997	15.6*	7.9	23.9
			1997	2010	1.3	–0.38	3.5
Bladder	C67	0	1991	2010	0.5	–0.5	1.6
		1	1991	1999	4.2*	0.9	7.6
			1999	2010	–1.7	–3.6	0.3
Brain, nervous system	C70-C72	0	1991	2010	1.6*	1.2	2.1
Thyroid	C73	0	1991	2010	8.5*	7.2	9.9
		2	1991	2000	5.4*	2.9	8.0
			2000	2003	25.4	–3.7	63.4
			2003	2010	2.3	–1.3	5.9
Ill-defined	C76-C80	0	1991	2010	4.6*	3.6	5.6
Hodgkin's lymphoma	C81	0	1991	2010	–1.6	–3.2	0.0
Non-Hodgkin's lymphoma	C82-C85	0	1991	2010	5.7*	4.6	6.7
Multiple myeloma	C90	0	1991	2010	2.1*	0.9	3.3
Leukemia	C91-C95	0	1991	2010	0.4	–0.4	1.2

* Annual percent change is statistically significant.

in new lung cancer diagnosis was seen in many European countries, particularly in Northern and Western areas (8, 9, 11), and was likely associated to decrease of smoking prevalence among men (12). Another site with decreasing incidence in most populations in the world is stomach cancer (13), nevertheless, incidence rates in Lithuania are still markedly higher than those in Western or Northern Europe (8). The decrease in incidence in Lithuania was also observed, but reasons for this worldwide decline in incidence are not fully understood, and are partly explained by changes in diet, reduction in chronic H. pylori infection due to improved hygiene and use of antibiotics (14–16).

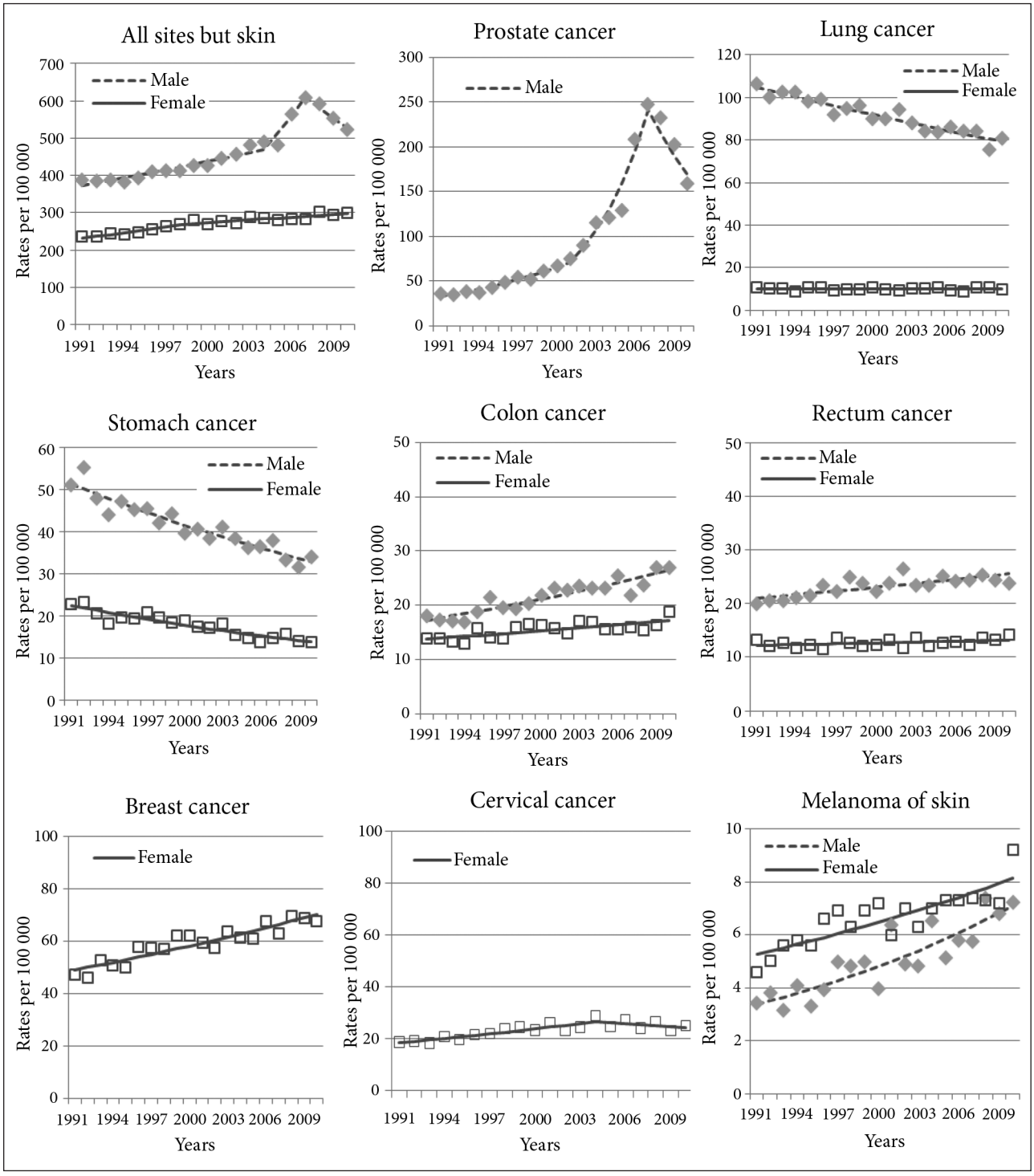

Fig. 2. Age-standardized incidence trends for selected cancers by sex in Lithuania in 1991–2010

Currently, prostate cancer is the most frequent cancer among males in Europe (17), as well as in Lithuania. Increasing incidence of prostate cancer was observed in other European countries, where prostate-specific antigen (PSA) testing has become widespread (18, 19). It remains unclear to what extent the rising trends in incidence rates could be attributed to an increased risk of developing this tumor or to an overdiagnosis due to opportunistic screening practices. In Lithuania, PSA testing is offered to healthy asymptomatic men as a screening test in the population-based Early Prostate Cancer Detection Programme since 2006. The extraordinary rise of prostate cancer incidence in

Lithuania following introduction of PSA screening was observed (20), and there is strong evidence that these changes are the result of increased detection rates, especially in men of eligible age for screening (20, 21). Such a huge number of newly diagnosed prostate cancer cases heavily influenced overall cancer incidence changes in male population.

Breast cancer is the leading cancer site in Europe among women, but incidence rate in our country is lower. In 2012 in Europe the estimated ASR was 94.2 per 100 000 women (8). Although the breast cancer screening program was started in Lithuania in 2005, our results have not found any changes in cancer incidence trends yet. Despite of the presence of the breast screening program in some countries, the differences of breast cancer incidence in Europe are likely due to variations in external risk factors across populations, such as age at birth of the first child and low parity (22).

Rising incidence of colorectal cancer might be due to changes in people eating and behaviour habits. Obesity, physical inactivity, smoking, heavy alcohol consumption, a diet high in red or processed meats, and inadequate consumption of fruits and vegetables, are also factors associated with economic development or westernization (23). Lithuania is not a long-standing economically developed country and we expect to see further increase in colorectal cancer incidence. What is more, the screening program based on the faecal occult blood test was started in Lithuania in 2009 and it is still too early to see the impact on incidence.

Possible stabilization in changes in cancer incidence might be seen for bladder cancer. Significant rises of ASRs were seen until 2001 and 1999 in men and women, respectively, with no meaningful changes later on. Bladder cancer is becoming rarer in Western communities over the last decades (24) and we could expect the same changes in the future in Lithuania. This stabilization in cancer incidence is partly due declines in the smoking prevalence together with reduced occupational exposure to carcinogens (12).

Cervical, endometrial, and ovarian cancers are relatively common, and cause significant cancer morbidity and mortality worldwide. In Lithuania, the incidence of cervix and corpus uteri cancers increased slightly during the study period and was stable for ovarian cancer. Cervical cancer trends in a given country mainly depend on the existence of effective screening programmes and time changes in disease risk factors, notably exposure to human papillomavirus (25). An organized screening program for cervical cancer using the Pap smear was started in Lithuania in 2004, however, incidence of invasive cervical cancer did not start to decrease in recent years. Endometrial cancer affects postmenopausal women almost exclusively. Endometrial cancer risk has been previously associated with several host factors, including high body mass index, nulliparity or low parity, early age at the first birth, history of type 2 diabetes mellitus (non-insulin dependent), and family history of cancer, particularly endometrial cancer (26, 27). The aetiology of ovarian cancer is not well understood. Established risk factors for ovarian cancer include age and having a family history of the disease, while protective factors include increasing parity, oral contraceptive use, and oophorectomy (25). Many of the causes of ovarian cancer are yet to be identified. Additional research is needed to better understand the aetiology of this disease.

Improvements in diagnosis may contribute to the rising incidence of kidney and thyroid cancer. It is known that thyroid cancer is more common among women (28), but increase in incidence among men is also observed which is most likely due to new diagnostic technologies (29). Considering kidney cancer, both incidence of late-stage renal cell carcinoma and mortality have also been increasing, implying that risk factors are contributing to this upward trend (30, 31). Among this cancer risk factors there are not only life-style risk factors like smoking, diet and obesity, use of some drugs etc., but environmental risk factors like occupational exposure to different chemicals, radiation, renal dialysis as well, participating probably in the aetiology of kidney cancer.

While considering haematological cancers, incidence in Lithuania had the same trends as in most European countries, where incidence of non-Hodgkin's lymphoma rose between 1% and 5% per year in both sexes in most European countries, alongside a decrease in Hodgkin's lymphoma (32). The reasons for these trends in non-Hodgkin's lymphoma and Hodgkin's lymphoma incidence are still largely unknown.

This analysis in time trends for cancer incidence provides an estimate of the burden of cancer in a certain population which is a useful tool for

planning cancer control. Identification of changing epidemiological patterns in cancers is crucial in formulating future health care clinical tools, evaluating prognostic and therapeutic models, and generating new hypotheses on disease aetiology and prevention.

CONCLUSIONS

This up-to-date analysis provides a basis for establishing priorities to cancer control actions in Lithuania. These results show the increase in incidence rates in Lithuania of all cancers combined among both sexes. Trends in cancer incidence rates for males were heavily influenced by trends in prostate cancer which is the most common cancer among men. With the major exceptions of male lung cancer and stomach cancer in both sexes, in the last two decades cancer incidence has increased in Lithuania for most cancers. Increasing cancer incidence requires targeted interventions on risk factors control, early diagnosis, and improved management and pharmacological treatment for selected cancer sites.

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Ieva Vincerževskienė, Agnė Krilavičiūtė, Giedrė Smailytė

SERGAMUMO VĖŽIU POKYČIAI LIETUVOJE 1991–2010 METAIS

Santrauka

Įvadas. Sergamumo vėžiu pokyčių analizė padeda įvertinti vėžio paplitimą tam tikroje populiacijoje ir yra naudinga planuojant vėžio kontrolės gaires. Dėsningumų vėžio epidemiologijoje stebėjimas yra esminė priemonė planuojant sveikatos priežiūros klinikines priemones, įvertinant prognostinius ir gydymo modelius bei keliant naujas hipotezes dėl ligos etiologijos ir jos prevencijos.

Tyrimo medžiaga ir metodai. Į analizę buvo įtraukti Lietuvos pacientai, kuriems vėžys buvo diagnozuotas 1991–2010 metais. Buvo apskaičiuoti pasirinktų vėžio lokalizacijų atskirai abiejų lyčių intensyvūs ir standartizuoti sergamumo rodikliai bei metinis procentinis pokytis kartu su 95 % pasikliautiniais intervalais naudojant Jointpoint regresijos analizę.

Rezultatai. Per pastaruosius dešimtmečius padaugėjo daugumos lokalizacijų vėžio susirgimų, ženkliai sumažėjo tik vyrų plaučių vėžiu ir abiejų lyčių skrandžio vėžiu sergamumas. Labiausiai išaugo sergamumas prostatos vėžiu ir moterų – skydliaukės vėžiu. Bendram visų vėžio lokalizacijų rodikliui tarp vyrų ženklią įtaką turėjo išaugęs naujai diagnozuotų prostatos vėžio atvejų skaičius.

Išvados. Atlikta analizė suteikia galimybę pasirinkti prioritetus vykdant vėžio kontrolę Lietuvoje. Mūsų rezultatai rodo abiejų lyčių bendrą sergamumo visų lokalizacijų vėžiu rodiklių augimą. Vyrų sergamumo vėžiu bendro rodiklio pokyčiams didelę įtaką turėjo išaugęs sergamumas prostatos vėžiu, šis vėžys buvo dažniausias piktybinis navikas tarp vyrų. Augant sergamumui vėžiu, daugiau dėmesio reikėtų skirti vėžio rizikos veiksnių kontrolei, ankstyvajai diagnostikai, taip pat efektyvesniam onkologinės pagalbos valdymui bei medikamentiniam gydymui.

Raktažodžiai: sergamumas vėžiu, tendencijos, metinis procentinis pokytis