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Estimates of cancer burden in Liguria

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ABSTRACT

Aims and background. The regional health care system of Liguria caters for a resident population which is among the oldest in Europe. One population-based cancer registry is present in the region, providing incidence and survival data for the Genoa province (covering 55% of the regional population). This paper will estimate the incidence, prevalence and mortality in the Liguria region for cancers of the lung, breast, prostate, colon-rectum, stomach and uterine cervix and melanoma of the skin in 1970-2015.

Methods. The estimated figures were obtained by applying the MIAMOD method. Starting from mortality and survival data, incidence and prevalence were derived using a statistical back-calculation approach. Survival was modeled on the basis of published data from the Italian cancer registries. The MIAMOD method was applied also to estimate the colorectal cancer incidence, mortality and prevalence rates in the Ligurian provinces in the period 1988-2015.

Results. In 2012 about 1,500 new cases of breast cancer were expected in Ligurian women. The estimates for the other cancer sites were considerably lower, ranging from 839 (colon-rectum) to 54 (cervix). In men about 1,400 new cases were estimated for prostate cancer, while the incidence for the other sites ranged from 1,118 (colon-rectum) to 208 (skin melanoma). The breast cancer prevalence rate was more than 10 times the incidence rate in women, and the lung cancer prevalence rate was more than double the incidence rate in both sexes. Mortality rates were highest for lung cancer in men and breast cancer in women; the lowest rates were estimated for melanoma and cancer of the uterine cervix.

Conclusion. In Liguria a large portion of the health expenditure has been devoted to diagnostic and therapeutic resources. This may have contributed to the reduction of mortality rates and to the improvement of cancer survival. This phenomenon, added to population aging, will inflate the cancer prevalence. One of the major challenges for the Liguria region is to face the increasing demand for oncology services.

Key words: cancer, incidence, prevalence, mortality, estimation, trend, geographic comparison, Liguria.

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Introduction

Liguria is a small Italian region with a population of 1,615,986 in 2010[1], more than half of whom were resident in the province of Genoa, the region's main city. The Liguria regional health care system is in a peculiar situation because its resident population is among the oldest in Europe. In 2010 Liguria had the highest percentage of residents aged 65 years and over (23% of men and 30% of women *versus* 18% and 23% in Italy), the highest aging index° (186 in men and 283 in women *versus* 118 and 172 in Italy) and the highest old-age dependency index* (36% in men and 51% in women

° % ratio between population ≥65 years of age and overall residents.
* % ratio between population aged ≥65 years and population aged 15-64 years.

versus 26% and 36% in Italy). The region's attractiveness and mild climate attract middle-aged and older tourists in every season, who often decide to take up residence in Liguria, thereby increasing the number of patients affected by chronic diseases that the Liguria regional health care system has to provide for. This weighs down on regional health expenditure (9.5% of GDP in Liguria *versus* 9% of GDP in Italy in 2010) and life expectancy (79.1 years in men and 84.1 years in women in Liguria *versus* 79.4 and 84.5 years in Italy in 2011)[1-3].

Liguria has a high educational level, ranking second in the percentage of people with a university degree in 2011 (13.2% *versus* 11.2% in Italy). Moreover, it is a moderately wealthy region, industrialized in the past and now characterized by an economy based on tourist and seaside activities and on house rent and revenue income. The region ranks second in the percentage of people employed in services and the tertiary sector in 2011 (78% *versus* 68% in Italy). It contributes with about 3% to the national GDP (2010 data)[2-3].

The population is served by 8 public hospital authorities (distributed over 24 sites) and 5 accredited private clinics, but the beds dedicated to oncology are very few[4]. There are 2 specialized cancer hospitals in the region: the National Cancer Research Institute, a comprehensive cancer center with 63 ordinary and 49 day-hospital beds that has been active since 1981, and the Gaslini Institute, a hospital and research center specialized in the care of children and attracting many patients from outside the region (334 ordinary and 69 day-hospital beds). There is a limited degree of health care migration (extraregional 5.4%, into the region 1.8%); extraregional migration is mostly to nearby Piedmont and some specialized national cancer centers[4].

Organized screening for breast cancer has been implemented since 2000, but not simultaneously by the various local health authorities (ASLs), so coverage has been different in different parts of the region. For example, ASL4 in the Genoa province has had 90% coverage since 2012, while ASL3 only reached 13% coverage in the same year. Also colorectal and cervical cancer screening has been implemented at different times by different ASLs, but more recently (2009-2010), so the coverage is very low[5].

One population-based cancer registry has provided incidence and survival data for the Genoa municipality from 1986 and the entire Genoa province from 1993. Therefore, about 55% of the regional population was covered by registration (Table 1).

Cancer is the second cause of death in Liguria, with 5,775 cancer deaths and the highest crude mortality rate in Italy (357.3 per 100,000 *versus* 275.6 in Italy in 2010)[6]. The Liguria age-standardized mortality rates are among the highest in Italy (sixth in both sexes, 371.5 in men and 202.0 in women)[6], so in this region cancer requires major efforts in primary care for diagnosis and treatment and in facing social needs.

This paper provides the basic epidemiological indicators of incidence, prevalence and mortality for the major cancers (lung, breast, prostate, colon-rectum, stomach, cervix uteri and skin melanoma) in Liguria in the period 1970-2015. Moreover, the same epidemiological indicators were estimated and presented at the provincial level for colorectal cancer only.

Material and methods

Mortality data for the considered cancer sites, general mortality and population data by age, calendar year and geographical region for the period 1970-2002 were obtained from the Italian National Institute of Statistics (ISTAT)[6]. Specific mortality data for the subsequent years, i.e. 2003, 2006 and 2007 (data for 2004-2005 were not yet published by ISTAT), were only used to validate the expected mortality projections. Relative survival data for the period of diagnosis 1985-2002 were obtained from the EUROCARE-4 study[7]. The data derive from 21 cancer registries in Italy, which jointly cover about 25% of the national population.

The MIAMOD method[8-11] was used for the estimation of incidence and prevalence. This statistical method is based on a back-calculation approach to estimate and project the morbidity of chronic irreversible diseases from mortality and patient survival. The method relies on the mathematical relationships between mortality, prevalence, incidence and survival. The model's estimation is based on mortality data from ISTAT for the period 1970-2002, with cause of death coded according to the ninth revision of the International Classification of Diseases (ICD-9)[12].

Relative survival of cancer patients was estimated from observed cancer registry data by means of parametric cure models of the Weibull type at the level of macro area. The geographical area and the age of patients were considered as categorical covariates in the survival model. The covariate "year of diagnosis" was parameterized, for each site and sex, as continuous or categorical – and as unique for all areas or variable by area – according to the pattern of observed survival data[11]. The survival estimates for northwest Italy were assigned to Liguria. The survival time trend after 2002 was assumed to have the same tendency as that estimated over the observation period 1985-2002 for all cancers except prostate cancer, for which survival was assumed to be constant from 2005 onwards. All incidence, mortality and prevalence estimates were carried out up to age 99. The MIAMOD method was applied also to estimate the colorectal cancer incidence, mortality and prevalence in the Liguria provinces in the period 1988-2015. For this analysis the observed provincial mortality in 1988-2006, drawn from the Liguria regional mortality registry, and the survival estimates for the northwest of Italy were used.

For cervical cancer, prostate cancer and skin melanoma, additional procedures were applied to account for specific problems related to these sites. The estimates for cervical cancer were performed after having estimated the regional cervical cancer mortality with a specific methodology[13,14] to correct the observed mortality data, which are largely incomplete due to misclassification with uterus not otherwise specified (NOS). The methodology could be applied from 1980 onwards because before that year the ICD-8 classification, which did not distinguish uterus NOS, was adopted in the ISTAT statistics. The corrected mortality figures were used as input data for incidence and prevalence estimates by the MIAMOD method. Estimates for cervical cancer were carried out up to age 94 because the distinction of uterus NOS cancer deaths into cervix and corpus uteri cancer deaths in women over 94 years old is not very reliable. Furthermore, for cervical cancer only limited-duration prevalence at 15 years was reported. Indeed, complete prevalence is highly sensitive to the past trends. Incidence estimates before 1980 for cervical cancer are unreliable due to the subsequent spread of non-organized early diagnosis and to the fact that neither mortality nor cancer registry data exist to support reliable modeling assumptions. Simple backward linear extrapolation of the decreasing trend estimated during the 1980s and 1990s may inflate the past incidence level and consequently (due to the high survival) the estimated prevalence of women with a diagnosis of cervical cancer.

For prostate cancer, because of the rapid changes in the recent time trends, more updated mortality data were used in order to capture recent variations that could not be modeled with data up to 2002. Since mortality data were differently coded (ICD-10) in 2003 and were missing in 2004-2005, mortality estimates with projections up to 2010 were preliminarily performed by means of the PIAMOD method[15]. The modeled mortality was then used as input for the MIAMOD method.

The projections of age-specific incidence and mortality rates for melanoma were obtained by linearly projecting the annual percent change of age-specific incidence and mortality estimated in the period 2001-2002. Age adjustment of rates was based on the standard European population.

Results

Table 1 reports the figures of cancer registration in Liguria, with the area and the size of the covered population, the corresponding coverage of the regional population, the percentage of people older than 65, and the data collection period. The number of cases and both the crude and age-standardized incidence and mortality rates and prevalence proportions estimated in Liguria for the year 2012 are presented in Tables 2A and 2B, respectively, for men and women.

In the male population, prostate cancer was the most frequent cancer, with 1,396 estimated new diagnoses. Incidence for the other cancers ranged between 1,118 (colon-rectum) and 208 (melanoma) estimated new cases. For women, 1,495 new cases of breast cancer were expected to be diagnosed in 2012. For the other cancers the numbers of estimated new cases were considerably lower and ranged from 839 (colon-rectum) to 54 (uterine cervix). Prevalence figures were more than 10 times the incidence figures for breast cancer in women and more than double the incidence figures for lung cancer in both sexes. The highest crude mortality rates were for lung cancer in men (108.3 per 100,000/year) and breast cancer in women (44 per 100,000/year) and the lowest ones for melanoma in both sexes and for cervical cancer in women.

For colorectal cancer, lung cancer, stomach cancer and melanoma, all the indicators were higher in men than women, the only exception being the prevalence of melanoma. The highest male:female ratio among the standardized incidence rates was reported for lung cancer (2.7) and the lowest for melanoma (1.1); for mortality, the highest male:female ratio was for lung cancer (slightly more than 3) and the lowest for gastric cancer (1.7). The male:female ratios for prevalence ranged from 2.6 (lung cancer) to 0.7 (melanoma).

The time trends of the 3 indicators over the period 1970-2015 are shown in Figures 1 to 6. They present the age-standardized incidence in men (Figure 1) and women (Figure 2), the age-standardized mortality in men (Figure 3) and women (Figure 4), and the crude prevalence in men (Figure 5) and women (Figure 6). The results will be described below, grouped by cancer site.

Stomach

The incidence and mortality of stomach cancer were estimated to decline steadily over the whole period. The expected decline in incidence and mortality in men was from 46 and 40, respectively, per 100,000 in 1970 to 14 and 9 in 2015. The corresponding trends in women were similar and the rates were lower than in men (from 23 and 20 per 100,000 in 1970 to 9 and 5 per 100,000 in 2015).

Colon and rectum

For colorectal cancer the male incidence rates were estimated to rise over the whole period (from 43 per 100,000 in 1970 to 78 in 2015). In women the trend was different: it increased until 1994 (to 44 per 100,000 from 34 in 1970), and decreased thereafter to 39 per 100,000 in 2015. The mortality trend in women reflected the incidence trend but preceding it by 15 years and with a more pronounced rate of decrease. The mortality trend in men was quite similar to that estimated in women, but with a later decrease (starting in 1988) and higher rates overall than in women.

Lung

The lung cancer incidence rates in men reached their peak during the mid 1980s (with a maximum rate equal to 101 per 100,000 in 1985) and decreased thereafter to 58 per 100,000 in 2015. For women a continuous increase is estimated up to 26 per 100,000 in 2015. Due to the very poor prognosis of this cancer, the mortality trends closely mimic those estimated for incidence, with about 9 points' difference between incidence and mortality. In women, lung cancer was the second cause of cancer death after breast cancer from 2007 onward and is expected to become the first in 2013.

Skin melanoma

The melanoma incidence rates were estimated to increase uniformly for both genders. In men, we estimated a 10-fold increase from 2 to 23 per 100,000/year during the period 1970-2015. Trends in women were similar with rates only slightly lower than in men (from 3 to 20 per 100,000). The mortality rates were low due to the high survival of melanoma patients. The male and female mortality rates reached a peak during the mid 1990s (2.6 in men in 1995; 1.8 in women in 1993) and tended to decrease thereafter.

Breast

Breast cancer in women was estimated to increase rapidly from 53 per 100,000 in 1970 to about 109 in the early 2000s. The incidence rates are estimated to decrease slightly in the subsequent years, down to 105 in 2015. Projections for breast cancer incidence are to be taken with caution, as this indicator reflects more the impact of early diagnosis and screening activities than the natural evolution of risk factors. The mortality reached a peak in 1985 (33 per 100,000) and then declined steadily to an expected rate of 16 per 100,000 in 2015.

Cervix uteri

During the study period the cervix cancer incidence and mortality rates declined sharply, reaching the lowest figures among the considered malignancies: the incidence was estimated to decline from 15 to 4 per 100,000 and the mortality from 7 to 1.5 per 100,000 between 1980 and 2015.

Prostate

The prostate cancer incidence trend was estimated to increase from 35 to 101 per 100,000/year during the period 1970-2003. Thereafter the rates seemed to decline, reaching the value of 79 per 100,000 in 2015. The mortality remained stable from 1970 to 1986 (21-22 per 100,000) and then started to decrease until 2015 (13 per 100,000), with an estimated reduction of 41% with respect to the peak level.

Prevalence

Prevalence increased for all cancers considered except cervix and stomach cancer in women. The increase was striking for breast, prostate and, to a lesser extent, colorectal cancer. The stomach cancer prevalence reached a plateau in men due to the impressive reduction of the incidence rate.

Colorectal cancer incidence, mortality and prevalence estimates by province

The estimates of the incidence, mortality and prevalence of colorectal cancer by province are shown in Tables 3A for men and 3B for women. In 2012 the highest age-standardized incidence rates were in Genoa for men and in Savona for women, the lowest in Savona for men and in La Spezia for women. The highest age-standardized mortality rates were observed in Imperia for men and in Genoa for women, the lowest in La Spezia for men and in Savona for women. More than half of the estimated prevalent cases lived in Genoa (57%), 17% in Savona, 13% in Imperia and a similar percentage in La Spezia.

Figures 7-9 illustrate by gender the 1988-2015 trends of estimated incidence, mortality (age-standardized rates per 100,000) and prevalence (proportion per 100,000) for colorectal cancer in the 4 provinces of Liguria. The incidence estimates (Figure 7) showed different sex-related behaviors. In men, Genoa and Imperia showed initially moderately rising trends: Genoa until 2009 (from 69.5 to 77.6) and Imperia until 2003 (from 58.2 to 69.2). Then the rates leveled off in Genoa and slightly decreased in Imperia (to 63.7). The rates increased moderately throughout the considered period in La Spezia (from 65.4 to 69.1) and remained stable in Savona (from 65.2 to 65.6). In women, there was a slightly increasing trend in Savona until 2003 (from 40.9 to 44.3), which subsequently leveled off. The incidence rates were relatively stable in Imperia (from 41.5 to 42.3) and showed a sharp decline in Genoa (from 53.7 to 39.3) and La Spezia (from 41.6 to 36.2).

The mortality estimates (Figure 8) showed a general decline: from initial values in men between 31.4 in Imperia and 38.9 in Genoa to final values between 21.7 in La Spezia and 28.5 in Savona; in women from initial values between 22.1 in Savona and 30.4 in Genoa to 13.2 in Savona and 18.5 in Imperia.

The prevalence increased markedly in all provinces: in men from initial values between 306 in Imperia and 391 in La Spezia to final values between 1,014 in La Spezia and 1,164 in Genoa; in women from initial values between 317 in Imperia and 398 in Genoa to final values between 836 in La Spezia and 946 in Savona.

Discussion

This paper provides an updated description of the burden of the major cancers in the Liguria region in

terms of time trends through 2015 and point estimates in 2012. Comparison between the estimated regional incidence and the data of the Genoa province cancer registry showed a good match over the time period covered by cancer registration.

The province-specific estimates carried out for colorectal cancer give a more detailed view of this cancer's trend in the Liguria region and show a substantial and interesting heterogeneity among the provinces. The overall estimated incidence and mortality patterns are consistent with the corresponding regionally estimated trends. However, it should be noted that the provincial figures, when summed up, do not show a perfect match with the corresponding regional estimates due to the quite complex nonlinear model-based approach used for both estimates.

The incidence rates are still rising for lung cancer and melanoma in women and colorectal cancer and melanoma in men. By contrast, the rates have been declining since 1970 for stomach cancer in both sexes and cervix cancer in women. The rates increased, reached a peak and then decreased for lung and prostate cancer in men and for breast and colorectal cancer in women, even if the decreases in the latter cancer sites are still weak.

The major risk factor affecting the observed trends is smoke, which is related to lung, stomach and cervical cancers, with a very high attributable risk for lung cancer and a lower one for stomach and cervical cancer[16]. The smoking prevalence in Italy has been decreasing among men since the 1970s. By contrast, smoking is on the rise in women, approaching the proportion of male smokers in the 1990s. In Liguria, the smoking prevalence time trend is decreasing in the male population, while it is stable among women: in 2011 the estimated prevalence of smokers among men aged 15 years or more was 26.8%, compared with a national estimate of 28.7%. The corresponding percentages in women were 15.9% and 16.8%, respectively. These figures are among the highest values in northern Italian regions[2,3,17].

Diet is an important risk factor for stomach, colorectal, breast and prostate cancer. Diet in Western developed countries has changed in recent years, with increased consumption of energy-dense foods and sugary drinks, and decreased use of salted or smoked preserved foods, which are particularly associated with stomach cancer[18]. We do not have information about food consumption in the Liguria population; however, the proportion of the population that was overweight or obese was less than the national average (53.5% in Liguria *versus* 56.2% in Italy in men and 33.1% in Liguria and 36.1% in Italy in women in 2011)[2,3]. The PASSI study reported a proportion of the population of Liguria with a body mass index greater than 25 of 49.4% in men and 32.6% in women, *versus* 55.5% and 37.2%, respectively, for the Italian population[19,20].

Screening programs as well as non-organized early-diagnosis activity have a high impact on the incidence trends of breast, cervical and prostate cancer and, to some extent, also colorectal cancer. In Liguria, according to the PASSI annual report 2009[21], the access to Pap tests to detect cervical cancer for women aged 25-64 years was high, with 83% of eligible women having had at least 1 test in the last 3 years. By contrast, the corresponding percentage of women tested within the organized screening programs was very low (13%)[5,22]. The access to mammograms for 50- to 69-year-old women was high (75% screened in the last 2 years) in the same period, but the percentage of women tested as part of organized screening was one of the lowest in Italy (34%)[23]. For colorectal cancer screening in Liguria, as in most regions, the access to effective screening tests (fecal occult blood test or endoscopy in the last 2 years) was low (16%) and the percentage of people tested as part of organized screening only 7%[24]. For this cancer, the slight reduction of incident cases observed in women cannot be attributed to the start of screening. The changes are more likely connected to a more widespread knowledge of the risk factors for colorectal cancer and to the stabilization of their prevalence among the population. Analysis of the trend in the 4 provinces confirms the still very low impact of the screening procedures shown in the PASSI report, probably related to the aging of the population, the distance from the main cancer care centers, and the difficulties in reaching them due to the troublesome road connections. In fact, mortality rates in the small municipalities farthest away from the main care centers were particularly high (data not shown). Moreover, we have to consider the sizeable immigration to the Liguria provinces of elderly people from the other northwestern regions, who bring along the risk factors and life habits of their original area (particularly Lombardy and Piedmont), which are more at risk than the ones in Liguria especially in terms of some dietary habits.

The incidence of skin melanoma is increasing in our region like in several other Western countries[25]. Various factors may contribute to this increase, including more frequent exposure to ultraviolet radiation, increased public awareness of the warning signs of melanoma, and increased screening by clinicians[26,27].

The huge increase in prostate cancer incidence was largely due to the spread of PSA testing and to opportunistic screening. We cannot say how much of the prostate cancer incidence rise is due to risk factors or to early diagnosis, including overdiagnosis. Since this rise is not accompanied by a corresponding increase in mortality, which was quite stable up to 2000 and then diminished, it could be principally due to a major contribution of overdiagnosis. In Liguria the incidence started to decline after 2005[28-30], as previously observed in many Western countries including the US and Nordic countries.

Mortality rates have been declining since the early 1990s for all the considered cancers except lung cancer in women. Mortality from lung cancer is largely influenced by incidence, owing to the very few therapeutic options[31,32], and the mortality rates were very close to the incidence rates.

Mortality is also related to survival, and to early diagnosis for those cancers that benefit from effective therapy given to patients with localized disease. The reduction of postoperative mortality, especially for colorectal, stomach and prostate cancer[33-36], and the more widespread availability of adjuvant hormonal therapy for breast cancer and adjuvant chemotherapy and neoadjuvant radiotherapy for colon and rectum cancer further contributed to the reduction of mortality[37,38].

Prevalence is the major indicator to identify patients' needs and influence health care organization. The burden of cancer treatment, clinical follow-up, palliation and social disabilities is well described by prevalence; therefore this indicator is important for resource allocation in health services planning. Tables 2A and 2B show that the demand is dominated by female breast cancer and male prostate cancer. It was estimated that in 2012 about 21,000 women with a diagnosis (new or old) of breast cancer were living in Liguria. In the same year 12,000 prevalent cases of prostate cancer were estimated.

Conclusion

A limit of this study could be the difficult interpretation of cancer trends for a resident population that is inflated by (mostly aged) people coming from other regions who were exposed to risk factors different from the ones typical of the native population. Liguria has a high health expenditure (in 2009 2,024 euro per capita *versus* 1,816 in Italy), a large proportion of which has been devoted to diagnostic and therapeutic resources and contributed to the reduction of the mortality rates in this relatively old population. Due to the benefit of early diagnosis, and partly to the improvement of treatment effectiveness, cancer survival will continue to increase in the next years. This phenomenon, added to the population aging and to the immigration of aged people from other regions, will inflate the cancer prevalence. To face the increasing demand for oncology services is one of the major challenges of the Liguria region.

Table 1 - Liguria population, proportion of the elderly population and cancer registry with its coverage and beginning of activity

		Population 2010	Population ≥65 years %	Coverage %	First year of incidence
Region	Liguria	1,615,986	26.6	-	-
Registry	RTRL - Genoa province	882,949	26.8	55%	1986

Table 2A - Estimated incidence, mortality and prevalence by cancer site for the year 2012 in Liguria. Number of cases and deaths, crude and European age-standardized (age-std) rates per 100,000 person-years and crude prevalence proportion per 100,000 persons. Age 0-99 years, men

	Incidence			Mortality			Prevalence	
Cancer site	Number of cases	Crude rate	Age-std rate	Number of deaths	Crude rate	Age-std rate	Number of cases	Crude proportion
Prostate	1,396	184.7	85.6	263	34.8	14.1	12,019	1,590.6
Stomach	209	30.3	14.8	143	20.8	9.7	936	135.5
Colon-rectum	1,118	161.8	78.6	402	58.2	26.6	7,291	1,055.5
Lung	892	128.9	64.4	749	108.3	52.4	2,157	311.8
Melanoma	208	30.1	21.1	26	3.8	2.2	1,924	278.6

Table 2B - Estimated incidence, mortality and prevalence by cancer site for the year 2012 in Liguria. Number of cases and deaths, crude and European age-standardized (age-std) rates per 100,000 person-years and crude prevalence proportion per 100,000 persons. Age 0-99 years, women

	Incidence			Mortality			Prevalence	
Cancer site	Number of cases	Crude rate	Age-std rate	Number of deaths	Crude rate	Age-std rate	Number of cases	Crude proportion
Breast	1,495	195.2	106.3	337	44.0	17.7	20,993	2,740.9
Stomach	170	22.2	8.8	117	15.3	5.6	785	102.5
Colon-rectum	839	109.7	40.2	308	40.3	13.3	6,311	824.4
Lung	415	54.2	24.1	316	41.4	17.2	902	117.9
Melanoma	208	27.2	19.0	19	2.5	1.2	2,865	374.2
Cervix	54	7.1	5.0	24	3.2	1.8	627*	82.2*

*Limited-duration prevalence at 15 years.

Table 3A - Colorectal cancer: incidence, mortality and prevalence in 2012 in Liguria provinces. Number of cases and deaths, crude and European age-standardized (age-std) rates per 100,000 person-years and crude prevalence proportion per 100,000 persons. Age 0-99 years, men

Province	Incidence			Mortality			Prevalence	
	Number of cases	Crude rate	Age-std rate	Number of deaths	Crude rate	Age-std rate	Number of cases	Crude proportion
Genoa	645	158.9	77.5	235	57.8	26.6	4,308	1,060.7
Imperia	161	160.3	66.1	58	57.4	29.5	975	971.6
La Spezia	139	137.3	68.7	50	49.6	23.1	943	943.4
Savona	187	143.7	65.5	65	50.2	28.6	1,260	968.8

Table 3B - Colorectal cancer: incidence, mortality and prevalence in 2012 in Liguria provinces. Number of cases and deaths, crude and European age-standardized (age-std) rates per 100,000 person-years and crude prevalence proportion per 100,000 persons. Age 0-99 years, women

Province	Incidence			Mortality			Prevalence	
	Number of cases	Crude rate	Age-std rate	Number of deaths	Crude rate	Age-std rate	Number of cases	Crude proportion
Genoa	519	115.9	41.9	194	43.2	19.4	3,900	870.6
Imperia	138	127.6	42.7	50	45.7	18.8	924	852.3
La Spezia	117	105.4	36.7	42	38.3	16.1	863	779.5
Savona	182	128.2	43.0	66	46.5	14.4	1,239	871.8

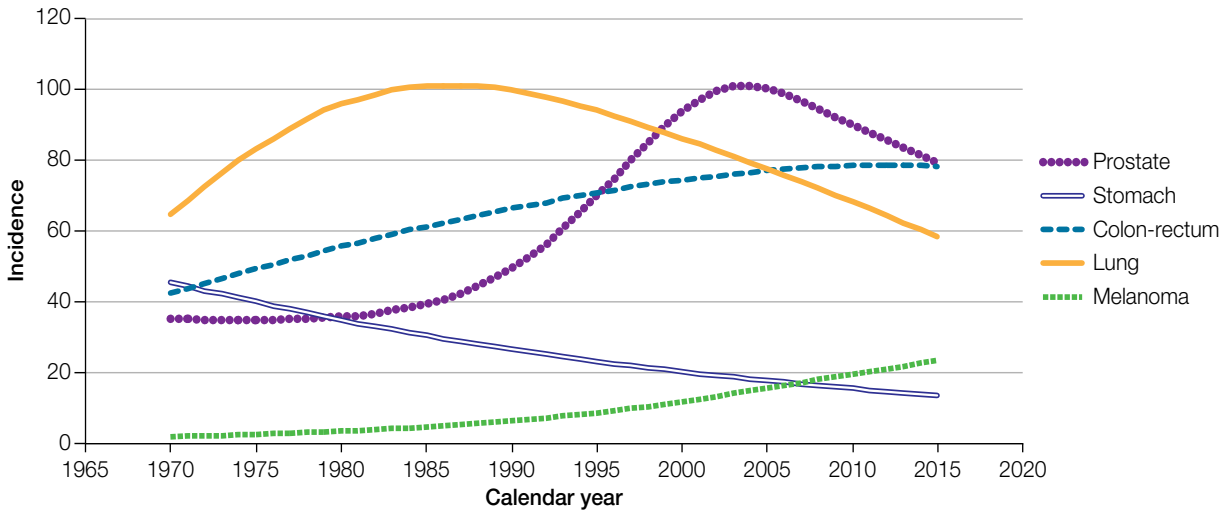


Figure 1 - Incidence estimates by cancer site in Liguria in the period 1970-2015. Age-standardized rates (European population) per 100,000 person-years. Age 0-99 years, men.

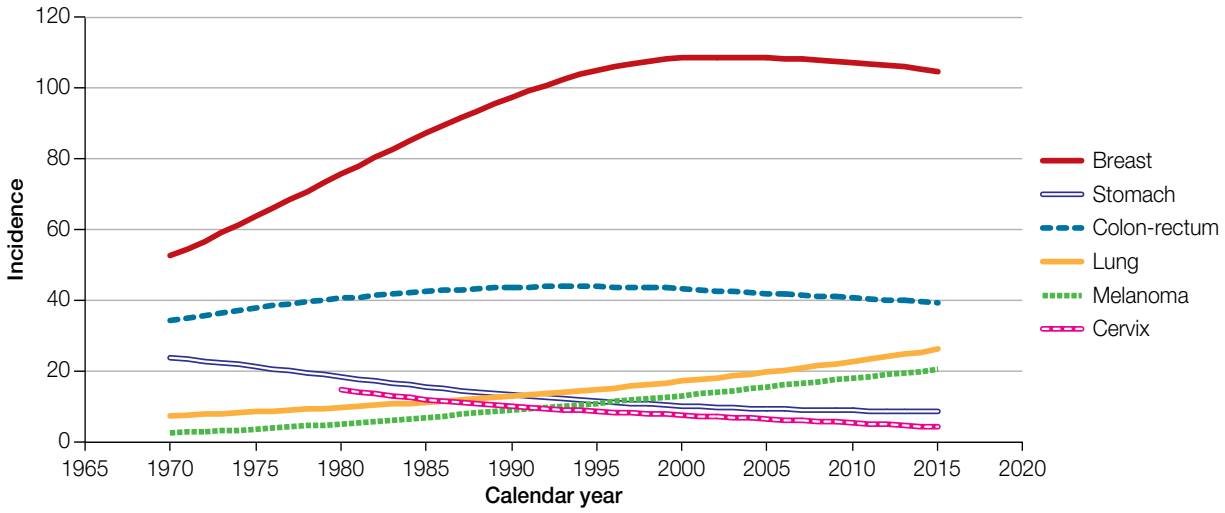


Figure 2 - Incidence estimates by cancer site in Liguria in the period 1970-2015. Age-standardized rates (European population) per 100,000 person-years. Age 0-99 years, women.

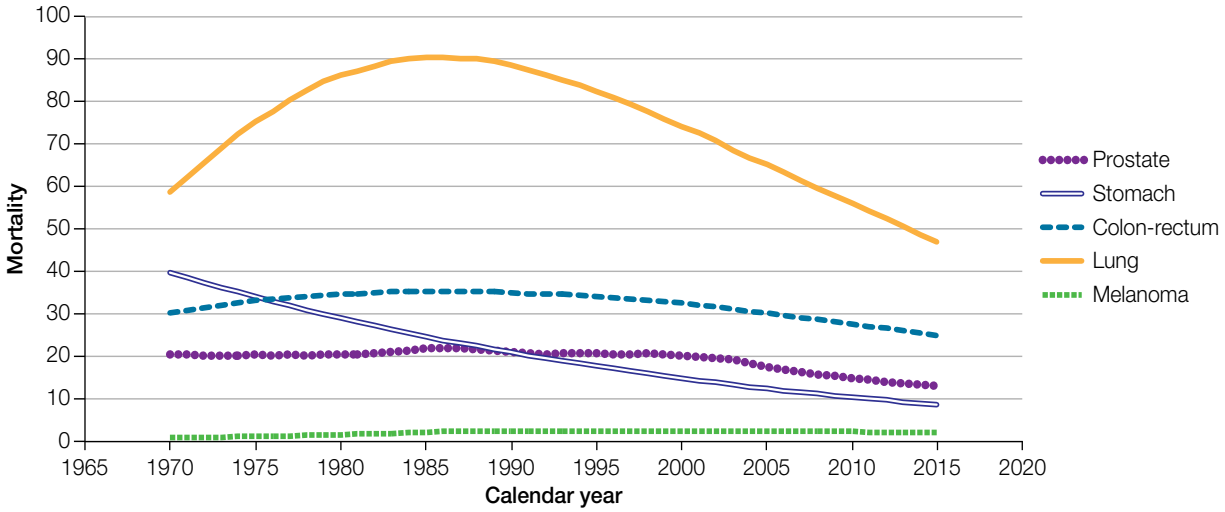


Figure 3 - Mortality estimates by cancer site in Liguria in the period 1970-2015. Age-standardized rates (European population) per 100,000 person-years. Age 0-99 years, men.

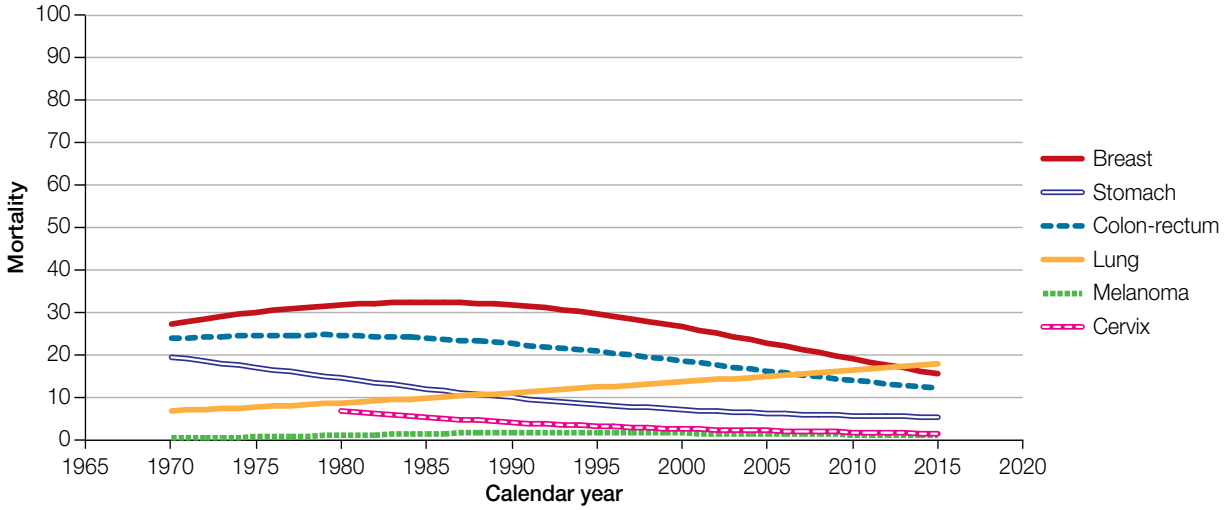


Figure 4 - Mortality estimates by cancer site in Liguria in the period 1970-2015. Age-standardized rates (European population) per 100,000 person-years. Age 0-99 years, women.

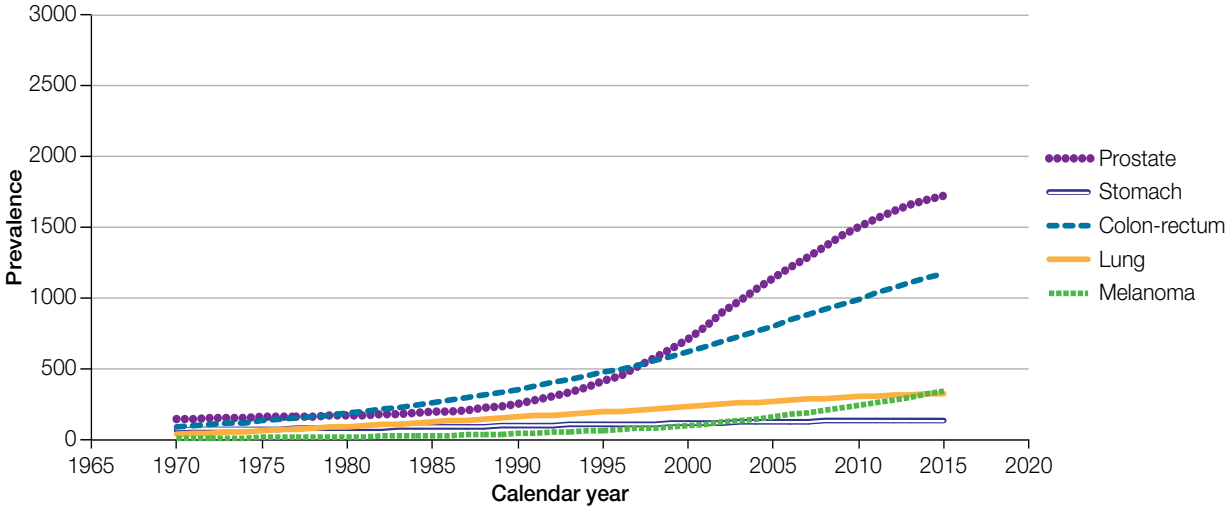
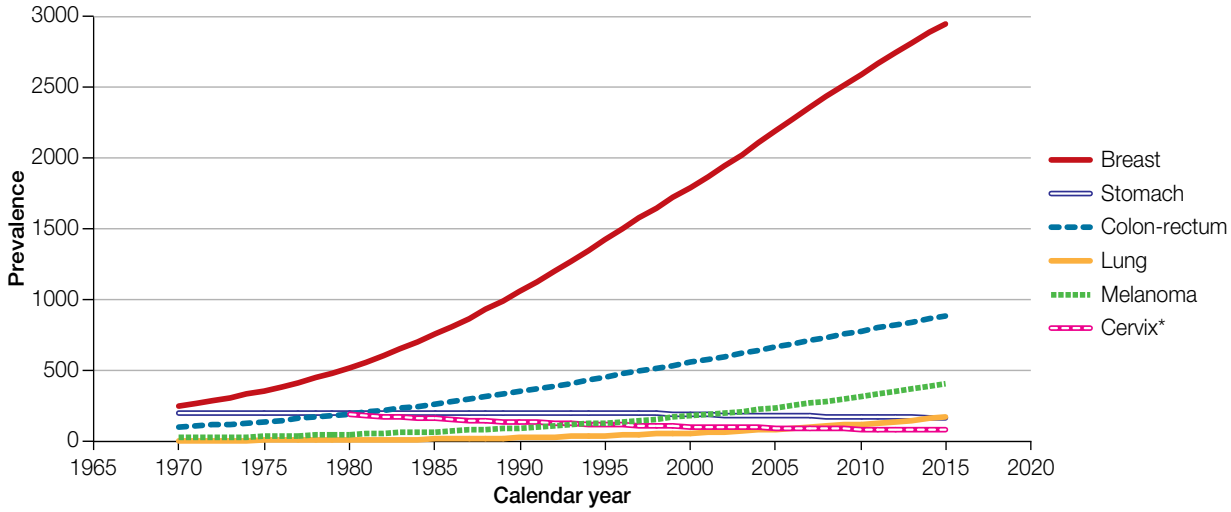


Figure 5 - Prevalence estimates by cancer site in Liguria in the period 1970-2015. Crude proportion per 100,000 persons. Age 0-99 years, men.



limited-duration prevalence at 15 years

Figure 6 - Prevalence estimates by cancer site in Liguria in the period 1970-2015. Crude proportion per 100,000 persons. Age 0-99 years, women.

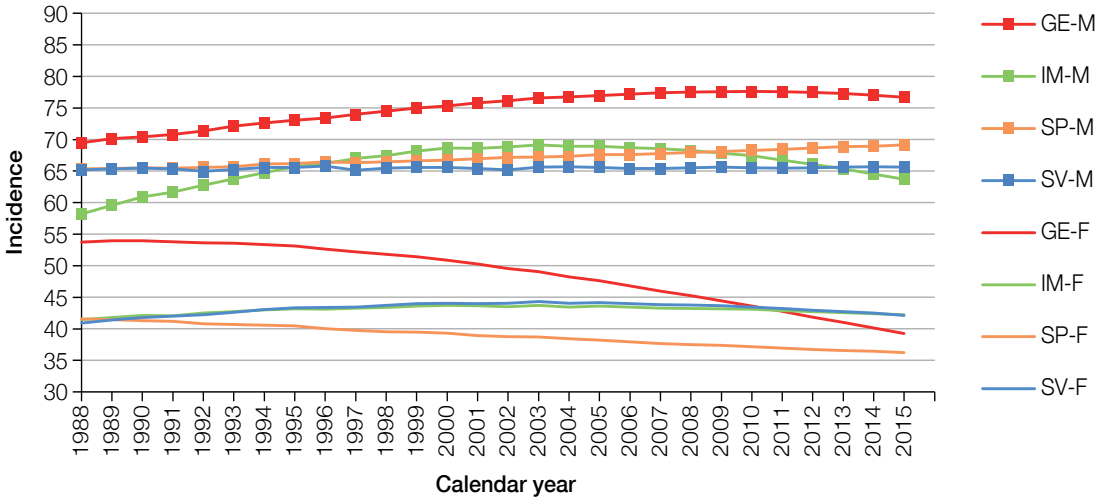


Figure 7 - Incidence estimates for colorectal cancer in Liguria provinces in the period 1988-2015 by gender. Age-standardized rates (European population) per 100,000 person-years. M, males; F, females; GE, Genoa; IM, Imperia; SP, La Spezia; SV, Savona.

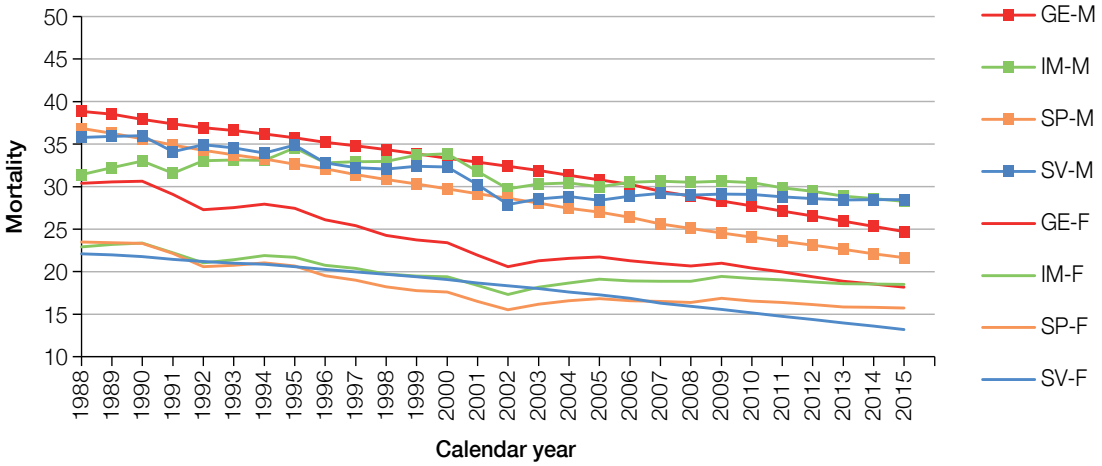


Figure 8 - Mortality estimates for colorectal cancer in Liguria provinces in the period 1988-2015 by gender. Age-standardized rates (European population) per 100,000 person-years. M, males; F, females; GE, Genoa; IM, Imperia; SP, La Spezia; SV, Savona.

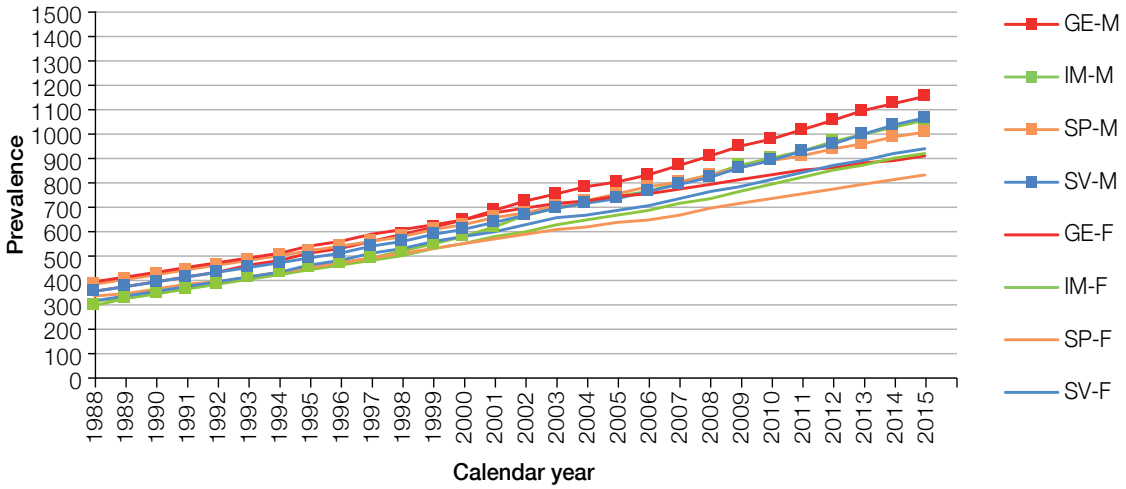


Figure 9 - Prevalence estimates for colorectal cancer in Liguria provinces in the period 1988-2015 by gender. Crude proportion per 100,000 persons.
M, males; F, females; GE, Genoa; IM, Imperia; SP, La Spezia; SV, Savona.

References

1. ISTAT: Popolazione residente 2010. http://demo.istat.it/pop2010/index.html (accessed 8 March 2013).
2. ISTAT: Health for all - Italia. Rome, December 2012. http://www.istat.it/it/archivio/14562 (accessed 8 March 2013).
3. Vercelli M, Quaglia A, Lillini R: Useful indicators to interpret the cancer burden in Italy. Tumori 99: 425-438, 2013.
4. ISTAT – Regione Liguria – Unioncamere Liguria. Annuario Statistico regionale. Liguria 2010.
5. Osservatorio Nazionale Screening. http://www.osservatorionazionalescreening.it//content/i-rapporti-annuali (accessed 8 March 2013).
6. ISTAT: Tavole di mortalità della popolazione residente, 2010.http://www.istat.it/it/archivio/80308 (accessed 8 March 2013).
7. Capocaccia R, Gavin A, Hakulinen T, Lutz JM, Sant M (Eds): Survival of cancer patients in Europe, 1995-2002: the EUROCARE-4 study. Eur J Cancer, 45: 901-1094, 2009.
8. Grande E, Inghelmann R, Francisci S, Verdecchia A, Micheli A, Baili P, Capocaccia R, De Angelis R: Regional estimates of all cancer malignancies in Italy, Tumori, 93: 345-351, 2007.
9. Verdecchia A, Capocaccia R, Egidi V, Golini A: A method for the estimation of chronic disease morbidity and trends from mortality data. Stat Med, 8: 201-206, 1989.
10. De Angelis G, De Angelis R, Frova L, Verdecchia A: MIAMOD: a computer package to estimate chronic disease morbidity using mortality and survival data. Comput Methods Programs Biomed, 44: 99-107, 1994.
11. Verdecchia A, De Angelis R, Francisci S, Grande E: Methodology estimation of cancer incidence, survival and prevalence in Italian regions. Tumori, 93: 337-344, 2007.
12. World Health Organization: International classification of diseases, 9th ed, WHO, Geneva, 1997.
13. Capocaccia R, Martina L, Inghelmann R, Crocetti E, De Lisi V, Falcini F, Guzzinati S, Rosso S, Tagliabue G, Tumino R, Vercelli M, Zanetti R, De Angelis R: A method to estimate mortality trends when death certificates are imprecisely coded: an application to cervical cancer in Italy. Int J Cancer, 124: 1200-1205, 2009.
14. De Angelis R, Rossi S, Martina L, Meduri C, Galati F, Capocaccia R: Stime di incidenza e mortalità per cervico-carcinoma in Italia. In: La prevenzione dell'infezione da papilloma virus umano in Italia. Atti del Workshop "La prevenzione dell'infezione da papilloma virus umano in Italia". Istituto Superiore di Sanità, Rome, 28 September 2009. Rapporti ISTISAN, 10/25: 4-11, 2009.
15. Verdecchia A, De Angelis G, Capocaccia R: Estimation and projections of cancer prevalence from cancer registry data. Stat Med, 21: 3511-3526, 2002.
16. Gandini S, Botteri E, Iodice S, Boniol M, Lowenfels AB, Maisonneuve P, Boyle P: Tobacco smoking and cancer: a meta-analysis. Int J Cancer, 122: 155-164, 2008.
17. Rapporto nazionale Passi 2009: Guadagnare salute. Abitudine al fumo. www.epicentro.iss.it/2/passi/fumo/fumo_Passi09.pdf (accessed 8 March 2013).
18. World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (AICR): Food, nutrition, physical activity, and the prevention of cancer: a global perspective. AICR, Washington DC, 2007.
19. Rapporto nazionale Passi 2010: Guadagnare salute. Sovrappeso e obesità. http://www.epicentro.iss.it/passi/rapporto2010/R2010SovrappesoObesita.asp (accessed 8 March 2013).
20. Rapporto nazionale Passi 2009: Guadagnare salute. Situazione nutrizionale. http://www.epicentro.iss.it/passi/rapporto2009/SituazioneNutrizionale09.asp (accessed 8 March 2013).
21. Rapporto nazionale Passi 2009: Guadagnare salute. http://www.epicentro.iss.it/passi/rapporto2009/IndiceRapporto09.asp (accessed 8 March 2013).
22. Rapporto nazionale Passi 2010: Guadagnare salute. Diagnosi precoce del tumore del collo dell'utero. http://www.epicentro.iss.it/passi/rapporto2010/R2010ScreeningCervicale.asp (accessed 8 March 2013).
23. Rapporto nazionale Passi 2010: Guadagnare salute. Diagnosi precoce del tumore della mammella. http://www.epicentro.iss.it/passi/rapporto2010/R2010Mammografia.asp (accessed 8 March 2013).
24. Rapporto nazionale Passi 2009: Guadagnare salute. Diagnosi precoce del tumore del colon-retto. http://www.epicentro.iss.it/passi/rapporto2010/R2010ColonRetto.asp (accessed 8 March 2013).
25. Curado MP, Edwards B, Shin HR, Storm H, Ferlay J, Heanue M, Boyle P (Eds): Cancer incidence in five continents, Vol IX, IARC Scientific Publications No. 160, IARC, Lyon, 2007.

26. Seidenari S, Benati E, Ponti G, Borsari S, Ferrari C, Albertini G, Altomare G, Arcangeli F, Aste N, Bernengo MG, Bongiorno MR, Borroni G, Calvieri S, Chimenti S, Cusano F, Fracchiolla C, Gaddoni G, Girolomoni G, Guarneri B, Lanzoni A, Lombardi M, Lotti T, Mariotti A, Marsili F, Micali G, Parodi A, Peris K, Peserico A, Quaglino P, Santini M, Schiavon S, Tonino C, Trevisan G, Tribuzi P, Valentini P, Vena GA, Virgili A: Italian Euromelanoma Day Screening Campaign (2005-2007) and the planning of melanoma screening strategies. Eur J Cancer Prev, 21: 89-95, 2012.
27. Nielsen K, Måsbäck A, Olsson H, Ingvar C: A prospective, population-based study of 40,000 women regarding host factors, UV exposure and sunbed use in relation to risk and anatomic site of cutaneous melanoma. Int J Cancer, 131: 706-715, 2012.
28. Malvezzi M, Arfé A, Bertuccio P, Levi F, La Vecchia C, Negri E: European cancer mortality predictions for the year 2011. Ann Oncol, 22: 947-956, 2011.
29. Oberaigner W, Siebert U, Horninger W, Klocker H, Bektic J, Schäfer G, Frauscher F, Schennach H, Bartsch G: Prostate-specific antigen testing in Tyrol, Austria: prostate cancer mortality reduction was supported by an update with mortality data up to 2008. Int J Public Health, 57: 57-62, 2012.
30. Bul M, Schröder FH: Screening for prostate cancer--the controversy continues, but can it be resolved? Acta Oncol, 50 (Suppl 1): 4-11, 2011.
31. van der Drift MA, Karim-Kos HE, Siesling S, Groen HJ, Wouters MW, Coebergh JW, de Vries E, Janssen-Heijnen ML: Progress in standard of care therapy and modest survival benefits in the treatment of non-small cell lung cancer patients in the Netherlands in the last 20 years. J Thorac Oncol, 7: 291-298, 2012.
32. Arfè A, Malvezzi M, Bertuccio P, Decarli A, La Vecchia C, Negri E: Cancer mortality trend analysis in Italy, 1970-2007. Eur J Cancer Prev, 20: 364-374, 2011.
33. Panis Y, Maggiori L, Caranhac G, Bretagnol F, Vicaut E: Mortality after colorectal cancer surgery: a French survey of more than 84,000 patients. Ann Surg, 254: 738-743, 2011.
34. Yamashita K, Sakuramoto S, Nemoto M, Shibata T, Mieno H, Katada N, Kikuchi S, Watanabe M: Trend in gastric cancer: 35 years of surgical experience in Japan. World J Gastroenterol, 17: 3390-3397, 2011.
35. Karanicolas PJ, Elkin EB, Jacks LM, Atoria CL, Strong VE, Brennan MF, Coit DG: Staging laparoscopy in the management of gastric cancer: a population-based analysis. J Am Coll Surg, 213: 644-651, 2011.
36. Schostak M, Baumunk D, Jagota A, Klopf C, Winter A, Schäfers S, Kössler R, Brennecke V, Fischer T, Hagel S, Höchel S, Jäkel D, Lehsnau M, Krege S, Rüffert B, Pretzer J, Becht E, Zegenhagen T, Miller K, Weikert S; Prostate Cancer Project Group of the Berlin Tumor Center, Inc., Germany: Time trends in prostate cancer surgery: data from an Internet-based multicentre database. BJU Int, 109: 355-359, 2012.
37. Berry DA, Cronin KA, Plevritis SK, Fryback DG, Clarke L, Zelen M, Mandelblatt JS, Yakovlev AY, Habbema JD, Feuer EJ; Cancer Intervention and Surveillance Modeling Network (CISNET) Collaborators: Effect of screening and adjuvant therapy on mortality from breast cancer. N Engl J Med, 353: 1784-1792, 2005.
38. Tsai WS, Hsieh PS, Yeh CY, Chiang JM, Tang R, Chen JS, Changchien CR, Wang JY: Impact of chemotherapy-related prognostic factors on long-term survival in patients with stage III colorectal cancer after curative resection. Int J Clin Oncol, 18: 242-253, 2013.