Estimates of cancer burden in Abruzzo and Molise

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ABSTRACT

Aims and background. Abruzzo and Molise are two regions located in the south of Italy, currently without population-based cancer registries. The aim of this paper is to provide estimates of cancer incidence, mortality and prevalence for the Abruzzo and Molise regions combined.

Methods. The MIAMOD method, a back-calculation approach to estimate and project the incidence of chronic diseases from mortality and patient survival, was used for the estimation of incidence and prevalence by calendar year (from 1970 to 2015) and age (from 0 to 99). The survival estimates are based on cancer registry data of southern Italy.

Results. The most frequently diagnosed cancers were those of the colon and rectum, breast and prostate, with 1,394, 1,341 and 698 new diagnosed cases, respectively, estimated in 2012. Incidence rates were estimated to increase constantly for female breast cancer, colorectal cancer in men and melanoma in both sexes. For prostate cancer and male lung cancer, the incidence rates increased, reaching a peak, and then decreased. In women the incidence of colorectal and lung cancer stabilized after an initial increase. For stomach and cervical cancers, the incidence rates showed a constant decrease. Prevalence was increasing for all the considered cancer sites with the exception of the cervix uteri. The highest prevalence values were estimated for breast and colorectal cancer with about 12,300 and over 8,200 cases in 2012, respectively. In the 2000s the mortality rates declined for all cancers except skin melanoma and female lung cancer, for which the mortality was almost stable.

Conclusion. This paper provides a description of the burden of the major cancers in Abruzzo and Molise until 2015. The increase in cancer survival, added to population aging, will inflate the cancer prevalence. In order to better evaluate the cancer burden in the two regions, it would be important to implement cancer registration.

Introduction

Abruzzo and Molise are 2 neighboring regions in the south of Italy with a population of about 1,340,000 and 320,000, respectively[1]. They have a lower GDP per capita than northern or central Italian regions; however, Abruzzo is the region with the highest GDP per capita among the southern regions[2]. The life expectancy at birth is similar to the national rate for both sexes[3]. Abruzzo and Molise in 2009 had an older population than Italy as a whole. The percentage of men older than 65 years of age was 19% both in Abruzzo and Molise, slightly higher than in Italy (17.5%). Women over 65 years were 24% in Abruzzo, 25% in Molise and 23% in Italy[3]. In 2009, the age-standardized mortality rates in Abruzzo for all causes were 1,051 and 670 per 100,000 in men and women, respectively; these rates were 1,010 and 643 in Molise[3]. The corresponding rates were slightly higher in Italy (1,065 in men and 683 in women).

Cancer is the second cause of death in Abruzzo and Molise, with 3,462 and 872 deaths, respectively, in 2008[4]. In 2009, the age-standardized mortality rates in Abruz-

zo for all cancer types were 305 and 161 per 100,000 for men and women, respectively; these rates were 310 and 151 in Molise[3]. In the years 2005-2007, 3 screening programs were activated in Abruzzo for the prevention of colorectal, breast and cervical cancer[5]. The same screening programs were activated in Molise in 2009[6].

Currently there are no population-based cancer registries in the 2 regions. Considering the relevance of cancer care at the population level and the fact that there are no cancer registries in the Abruzzo and Molise regions, the availability of estimates of the main epidemiological indicators is useful for public health planning.

This paper will provide the basic epidemiological indicators – incidence, prevalence and mortality – in the Abruzzo and Molise regions combined for the major cancers (lung, breast, prostate, colon-rectum, stomach, cervix uteri and skin melanoma).

Material and methods

Incidence, mortality and prevalence estimates were obtained by applying the MIAMOD statistical back-calculation method to survival and mortality data. All the analyses were carried out on the data referred to the pool of the 2 regions Abruzzo and Molise, and the results are presented accordingly. The MIAMOD method, as described elsewhere in detail[7-9], was applied to estimate the absolute number of incident cases, deaths and prevalent cases, crude and age-standardized (using the standard European population) incidence and mortality rates (per 100,000 person-years), and prevalence proportions (per 100,000) for the period 1970-2015. All estimates were carried out up to age 99 years.

Briefly, the MIAMOD method is based on mortality data and relative survival estimates. Mortality data for all cancers, general mortality and population data by age, calendar year, and geographical area for the period 1970-2002 were obtained from the Italian National Institute of Statistics (ISTAT)[4]. Specific mortality data for the years 2003, 2006 and 2007 were used to validate the expected mortality projections (ISTAT had yet to publish data for 2004-2005). Relative survival estimates were calculated by means of parametric cure models of the Weibull type at the level of macro area, using data from cancer registries included in the EUROCARE-4 study for the period 1985-2002[10]. The survival estimates for the southern macro area were assigned to Abruzzo and Molise for all cancer sites. The survival time trend after 2002 was assumed to have the same tendency as that estimated for the 1985-2002 period for all cancers except prostate cancer, where the survival was assumed to be constant from 2005 onwards.

For cervix cancer, prostate cancer and melanoma, additional procedures were applied to account for problems specifically related to these cancers. Cervical can-

cer estimates were only feasible from the year 1980, after the adoption in mortality statistics of the 9th revision of the International Classification of Diseases (ICD-9), which allowed to make a distinction between cancers of the cervix uteri, corpus uteri, and uterus not otherwise specified (NOS). Unfortunately, the official mortality statistics for cervical cancer are undersized because many cases were misclassified as uterus NOS cancers. For this reason, the estimates for cervical cancer were performed after adjustment for such misclassification, using the method proposed by Capocaccia *et al.*[11], and they were carried out only up to age 94 years. Furthermore, only limited-duration prevalence at 15 years is herein reported, as complete prevalence would not have been reliable.

For prostate cancer, a specific procedure was used to capture recent rapid variations in time trends, as suggested for the other Italian regions by the most recent cancer registry data[12]. Similar to what was done for other regional estimates, mortality projections up to 2010 were preliminarily performed by means of the PIAMOD method[13] so as to complete the missing mortality time series of the years 2004 and 2005[4] and to base the incidence estimates on mortality data at least 5 years after the suspected incidence turning point. This longer mortality time series was then used as input for the MIAMOD method.

For melanoma, the estimates of age-specific incidence and mortality rates were obtained by linearly projecting the age-specific annual percent change of the incidence and mortality rates estimated for the period 2001-2002. The age-standardized rates were based on the standard European population.

Results

The number of cases, crude and age-standardized incidence and mortality rates and prevalence proportions estimated in Abruzzo and Molise for the year 2012 are presented in Tables 1A and 1B, respectively, for men and women. In 2012 the most frequent cancer site in the male population was colon-rectum, with 850 estimated new diagnoses, followed by prostate and lung with 698 and 617 new diagnosed cases, respectively. A lower number of diagnoses of melanoma (151) and stomach cancer (240) was estimated. In the same year in the female population 1,341 new cases of breast cancer were diagnosed while for the other cancers the numbers of estimated new cases were considerably lower and ranged between 544 (colon-rectum) and 30 (cervix uteri).

The breast cancer prevalence figures in women were more than 9 times higher than the incidence rates. Prevalence was more than double the incidence for lung cancer in both sexes.

The highest crude mortality rates were for lung cancer in men (67.6 per 100,000) and breast cancer in

women (32.4 per 100,000), while the lowest figures were estimated for melanoma in both sexes (3.2 in men and 2.5 in women) and cervix uteri in women (2.3). For colorectal, lung, stomach cancer and melanoma, all the indicators were higher in men than in women.

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 trends for stomach cancer were estimated to decrease markedly during the whole represented period. In men, incidence and mortality decreased from 36 and 32 per 100,000, respectively, in 1970 to 19 and 12 per 100,000 in 2015. The trends in women were similar and the rates were considerably below (about half) those in men.

Colon and rectum

For colorectal cancer the male incidence rates were estimated to rise continually up to 2015, while in women they increased rapidly until the early 1990s and then leveled off. The female mortality increased until 1989 (16.4 per 100,000) then decreased, reaching in 2015 the lowest level within the considered period (11 per 100,000). The male mortality rates reached their peak during the late 1990s (26.9 per 100,000/year) and then started to decrease slightly, down to 25.1 per 100,000 in 2015.

Lung

The lung cancer incidence rates in men reached their peak during the mid 1990s with a maximum rate equal to 61 per 100,000 in 1994, and decreased thereafter to 46.6 per 100,000 in 2015. In women the incidence rates increased up to the early 2000s and then stabilized at around 8 per 100,000. Due to the very poor prognosis of lung cancer, the mortality trends closely mimicked those estimated for incidence. In men, lung cancer was estimated to be the first cause of cancer death from 1974 onwards.

Skin melanoma

The incidence rates for skin melanoma were estimated to increase continually in both genders. The incidence trends were similar in men and women until the mid 1990s. The incidence rates then rose much more rapidly in men than women, and have been about 60%-70% higher in men than women since the mid 2000s. In 2015 age-standardized incidence rates of 17 and 10 per 100,000, respectively, for men and women were estimated. The mortality rates were low, due to the high survival of melanoma patients, and they increased throughout the considered period in both sexes.

Breast

The breast cancer incidence in women was estimated to increase rapidly from 25 per 100,000 in 1970 to 127 in 2015. Projections based on observations up to 2002 predict a continuing increase. Breast cancer incidence forecasts are to be taken with caution because this indicator is very sensitive to the impact of screening activities, which are changing much more rapidly than the level of risk factors. Mortality reached a peak in 1990 (21 per 100,000) and then started to drop steadily to a foreseen level of 16 in 2015.

Cervix uteri

During the study period 1980-2015, all the epidemiological indicators for cervical cancer were estimated to decline considerably, reaching the lowest figures among the malignancies considered. In 2015, age-standardized incidence and mortality rates of 2 and 1 per 100,000, respectively, were estimated. The 15-year limited-duration prevalence is forecast to be about 33 per 100,000 in the same year.

Prostate

The incidence of prostate cancer was estimated to increase during the period 1970-2003 from 17 to 60 per 100,000/year. Thereafter the rates were expected to decline to 42 per 100,000 in 2015. The prostate cancer mortality increased from 1970 to 1999 and then started to decrease, with an estimated reduction by 2015 of about 37% with respect to the peak level. The age-standardized mortality rates were estimated to be 18.8 and 11.8 per 100,000, respectively, in 1999 and 2015.

Prevalence

Prevalence increased for all the considered cancers except cervix cancer, where the 15-year limited-duration prevalence was estimated to decrease throughout the study period. The increase in prevalence was less pronounced for stomach cancer due to the impressive reduction of its incidence, and it was striking for breast, prostate and colorectal cancer. The male prevalence proportions in 2012 for prostate cancer, stomach cancer, colorectal cancer, lung cancer and skin melanoma were 637.5, 128.2, 625.4, 179 and 158, respectively, per 100,000, while the female figures for breast cancer, stomach cancer, colorectal cancer, lung cancer and melanoma were 1,550.6, 76.5, 448, 44.6 and 122.8, respectively, per 100,000. For cervical cancer the 15-year limited-duration prevalence was 36.7 per 100,000 in 2012.

Discussion

The most recent available information about the cancer mortality in Abruzzo and Molise pertains to the year 2009, reporting a crude mortality rate of 260 per 100,000 for both regions[3]. To our knowledge, the only previously available information about the incidence and prevalence of cancer in the 2 regions was published in 2007 based on the same methodology applied here[7-9]. Those estimates provided for 2005 age-standardized incidence rates for all cancers of 241 and 245 per 100,000, respectively, in Abruzzo and Molise[14], and corresponding crude prevalence proportions of 2,168 and 2,152 per 100,000. All the cancer burden indicators in 2005 were slightly lower than the average of the southern regions (265, 241 and 245 per 100,000 for age-standardized incidence; 142, 127 and 127 per 100,000 for age-standardized mortality; and 1,515, 1,427 and 1,439 per 100,000 for age-standardized prevalence for southern Italy, Abruzzo and Molise, respectively) and lower than the national figures (303 per 100,000 for age-standardized incidence, 143 per 100,000 for age-standardized mortality, and 2,092 per 100,000 for age-standardized prevalence)[14].

This paper provides an update of all the epidemiological indicators in terms of time trends through 2015 and point estimates in 2012 in the Abruzzo and Molise regions combined. Unfortunately, no validation of these estimates with observed data can be carried out due to the lack of cancer registration in the 2 regions. However, a comparison can be made between our incidence estimates and the observed values published in the AIRTUM monograph of 2009 referring to the pool of southern Italian registries[15]. Our estimates match well with the pooled estimates of southern region registries. The only exception was breast cancer, for which we estimated an increase in the standardized incidence rates for the whole period, whereas in the AIRTUM publication no significant increase in incidence for the period 2000-2005 was reported.

The incidence rates were increasing steadily for breast cancer in women, colorectal cancer in men and melanoma in both sexes. For prostate cancer and lung cancer in men the rates increased, reaching a peak in different periods, and then decreased. For female colorectal and lung cancer the rates stabilized after an initial increase. At the opposite end, the incidence rates of stomach and cervix cancer showed a constant decrease. In the most recent years, the mortality estimates showed a downward trend for all considered cancers except skin melanoma and female lung cancer, where the mortality was almost stable. Lung, breast and colorectal cancer are estimated to remain the big killers for the near future.

Our estimates were pooled for the 2 regions for numerical reasons; this choice, however, may be inappropriate because the 2 regions may differ in terms of risk factors and effective cancer care. The previously published age-standardized mortality data for all cancers[14] showed identical mortality rates (127 per 100,000) for the 2 regions in 2005. We can therefore hypothesize that there are no important differences in risk factors and health organization between Molise and Abruzzo.

The major risk factors affecting the observed trend for some of the considered cancers is tobacco. Tobacco, with different attributable risks, is related to lung, stomach and cervical cancer[16]. The smoking prevalence in Abruzzo and Molise decreased slightly in the past 20 years[3]. In 2010 in Abruzzo, Molise and Italy 22%, 21% and 23%, respectively, of people aged more than 15 years were smokers[3]. The smoking prevalence in Abruzzo and Molise was lower than that in southern Italy (24%)[3]. In the period 1993-2010, the smoking prevalence trend in Abruzzo and Molise was relatively constant in women and decreasing in men[3]. The decreasing incidence of lung cancer in men reflected the diminishing prevalence of male smokers[3]. In women, the lung cancer incidence rates were stable in the final period of estimation and corresponded to an also stable smoking prevalence.

Diet, weight and physical activity have been associated with stomach, colon-rectum, breast and prostate cancer. The changes in incidence trends can be related in part to changes in the diet of the Italian population, with an increasing intake of energy-dense foods and sugary drinks and a lower consumption of salted or smoked preserved foods[17]. Body mass index (BMI) is associated with several cancers including breast and colorectal cancer. In 2010 the proportion of obese people (BMI >30) in the population of Abruzzo was 12%, while in Molise it was 11%: both proportions were higher than the national average (10%). In the same year the proportions of overweight people were 37%, 42% and 36%, respectively, in Abruzzo, Molise and Italy[3]. In 2010, 41% of citizens in Abruzzo had a fully sedentary lifestyle and only 24% reported engaging in heavy work or complying with the recommendations on physical activity; the corresponding rates for Molise were 22% and 28%[18]. Only 11% of interviewed subjects in Abruzzo and 7% in Molise for the 2010 PASSI report declared they complied with the international recommendation of consuming vegetables and fruit at least 5 times a day[18].

In Abruzzo screening programs have been active since 2005-2006 for the prevention or early diagnosis of cancer of the colon-rectum, breast and cervix. The screening program for cervical cancer addressed the female population resident in the region and aged between 25 and 64 years. Every woman was invited to a free Pap test once every 3 years[5]. The crude attendance rate for cervical cancer screening in 2009 was 21.5%[6]. Colorectal cancer screening was addressed to persons aged between 50 and 70 years. Each eligible subject was invited to have a free fecal occult blood test (FOBT) every 2 years[5]. Attendance of the FOBT program in Abruzzo was 77.9%[6]. Finally, breast cancer screening was addressed to women aged between 50 and 70 years, and every 2 years eligible

women received an invitation to a free mammogram[5]. The crude attendance rate for breast cancer screening in 2009 was 51.5% in Abruzzo and 56.6% in Molise[6]. The slight decrease in the mortality trends reported in this paper for breast, cervix and colorectal cancer over the last years cannot be attributable to the effect of screening because the implementation of the programs in both regions was too recent.

Prevalence measures the burden of cancer in its different phases: treatment, clinical follow-up, long-term effects and terminal phase. This indicator is therefore important for the organization of health services. Prevalence estimated in 2012 was particularly high for breast cancer (12,300 prevalent cases), colorectal cancer (8,233 prevalent cases) and prostate cancer (5,131 prevalent cases). Except in the case of lung cancer, for which the cessation of smoking is the central goal in reducing mortality, substantial diagnostic and therapeutic resources may contribute to the reduction of the cancer mortality rates in Abruzzo and Molise. Due to the benefit of early diagnosis and screening programs, and partly to improvement of therapeutic effectiveness, cancer survival will increase in the next years. This phenomenon, added to population aging, will inflate the cancer prevalence. In order to better evaluate the cancer burden in the 2 regions it would be important to implement cancer registration. Having to face the increasing demand for oncology services is one of the major challenges of the Abruzzo and Molise regions. However, primary prevention is the only way to simultaneously reduce the incidence, prevalence and mortality rates, thus saving further lives, reducing patients' suffering, and preserving health resources.

Table 1A - Estimated incidence, mortality and prevalence by cancer site for the year 2012 in Abruzzo and Molise. 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

Cancer site	Incidence			Mortality			Prevalence	
	Number of cases	Crude rate	Age-std rate	Number of deaths	Crude rate	Age-std rate	Number of cases	Crude proportion
Prostate	698	86.7	46.8	216	26.9	12.9	5,131	637.5
Stomach	240	32.1	19.6	169	22.6	13.2	959	128.2
Colon-rectum	850	113.6	68.8	335	44.8	25.5	4,679	625.4
Lung	617	82.5	49.9	506	67.6	39.7	1,339	179.0
Melanoma	151	20.2	15.4	24	3.2	2.2	1,182	158.0

Table 1B - Estimated incidence, mortality and prevalence by cancer site for the year 2012 in Abruzzo and Molise. 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

Cancer site	Incidence			Mortality			Prevalence	
	Number of cases	Crude rate	Age-std rate	Number of deaths	Crude rate	Age-std rate	Number of cases	Crude proportion
Breast	1,341	169.1	113.9	257	32.4	17.1	12,293	1,550.6
Stomach	154	19.5	9.5	114	14.4	6.7	607	76.5
Colon-rectum	544	68.6	31.9	222	27.9	11.9	3,554	448.0
Lung	134	16.9	8.1	112	14.1	6.5	353	44.6
Melanoma	107	13.4	9.3	20	2.5	1.3	974	122.8
Cervix	30	3.8	2.6	18	2.3	1.2	290*	36.7*

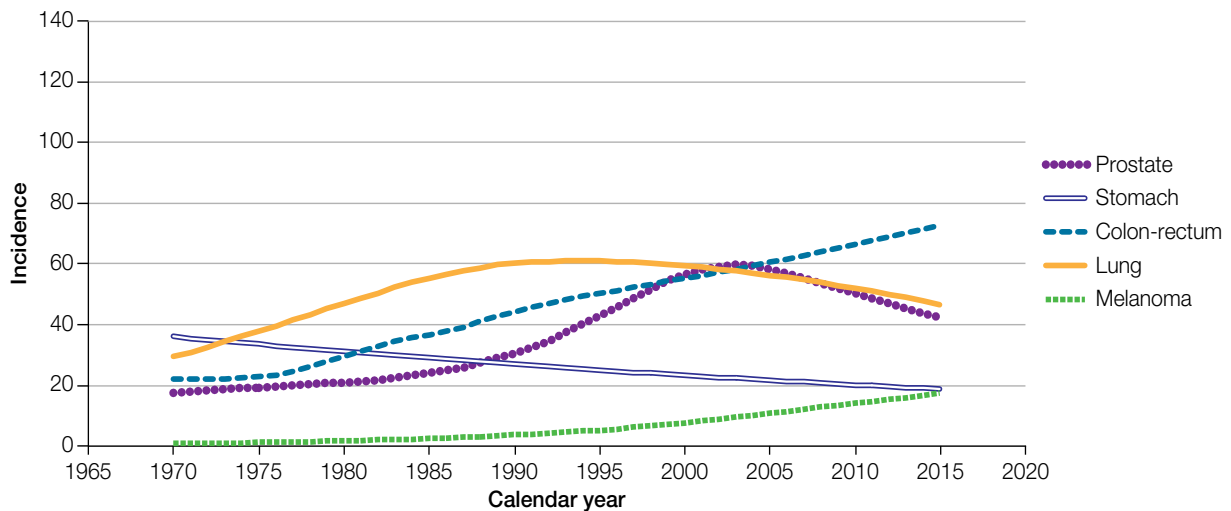*Limited-duration prevalence at 15 years.

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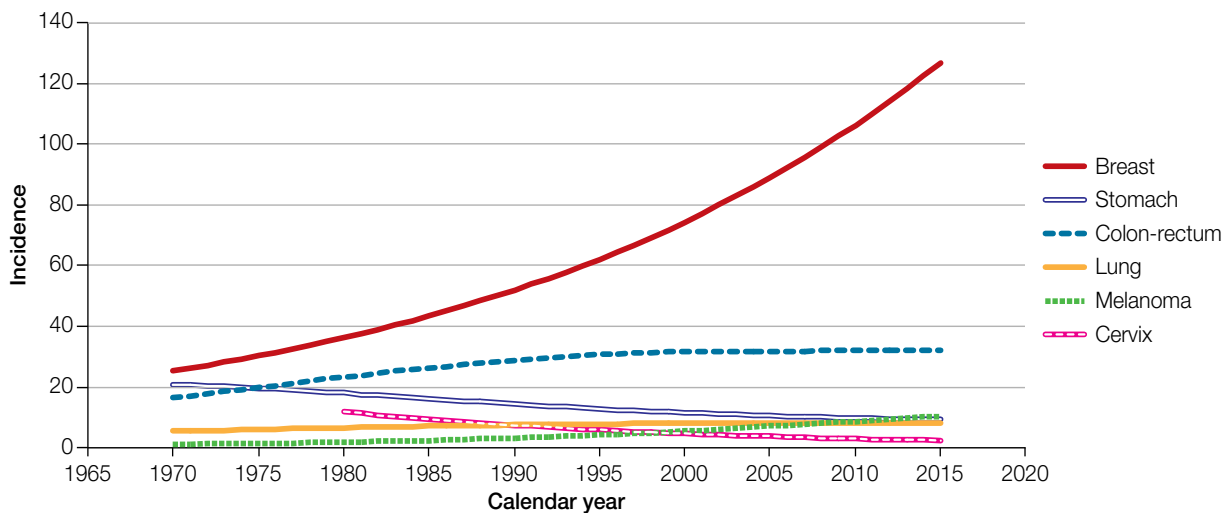

Figure 2 - Incidence estimates by cancer site in Abruzzo and Molise in the period 1970-2015. Age-standardized rates (European population) per 100,000 person-years. Age 0-99 years, women.
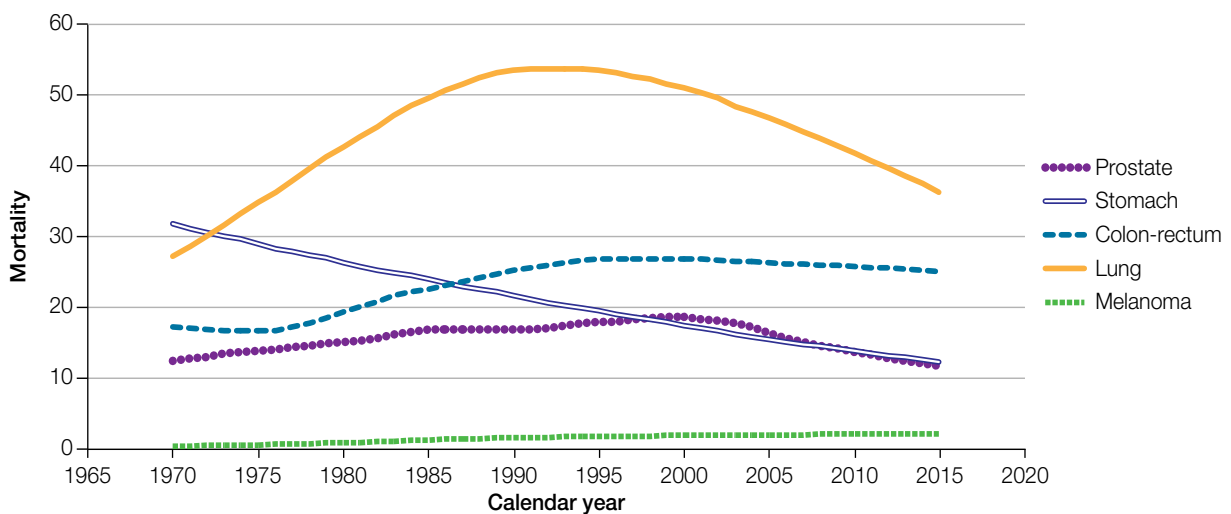

Figure 3 - Mortality estimates by cancer site in Abruzzo and Molise in the period 1970-2015. Age-standardized rates (European population) per 100,000 person-years. Age 0-99 years, men.
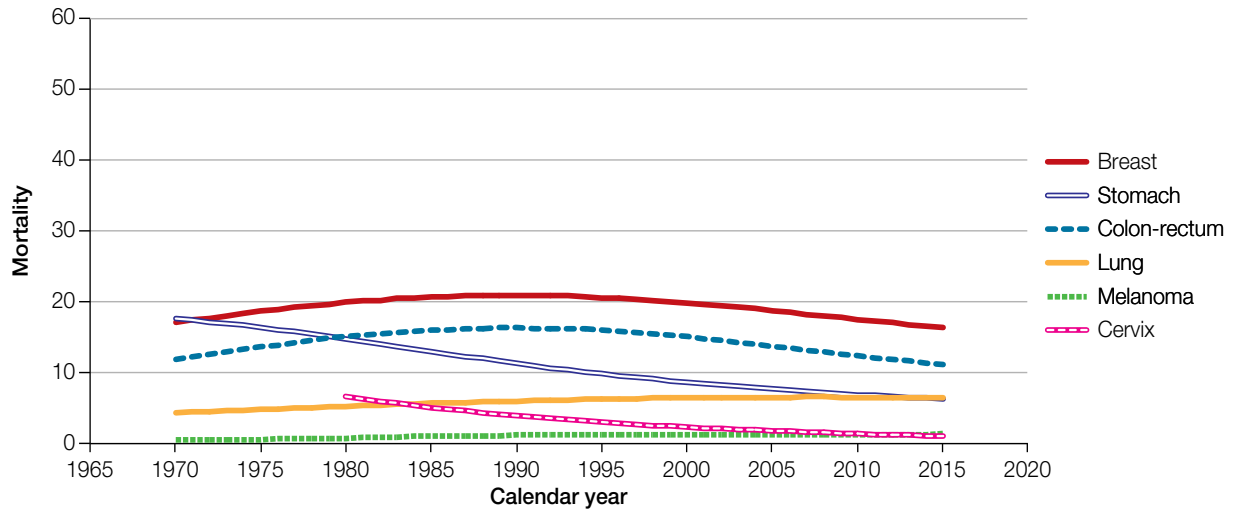
Figure 4 - Mortality estimates by cancer site in Abruzzo and Molise in the period 1970-2015. Age-standardized rates (European population) per 100,000 person-years. Age 0-99 years, women.
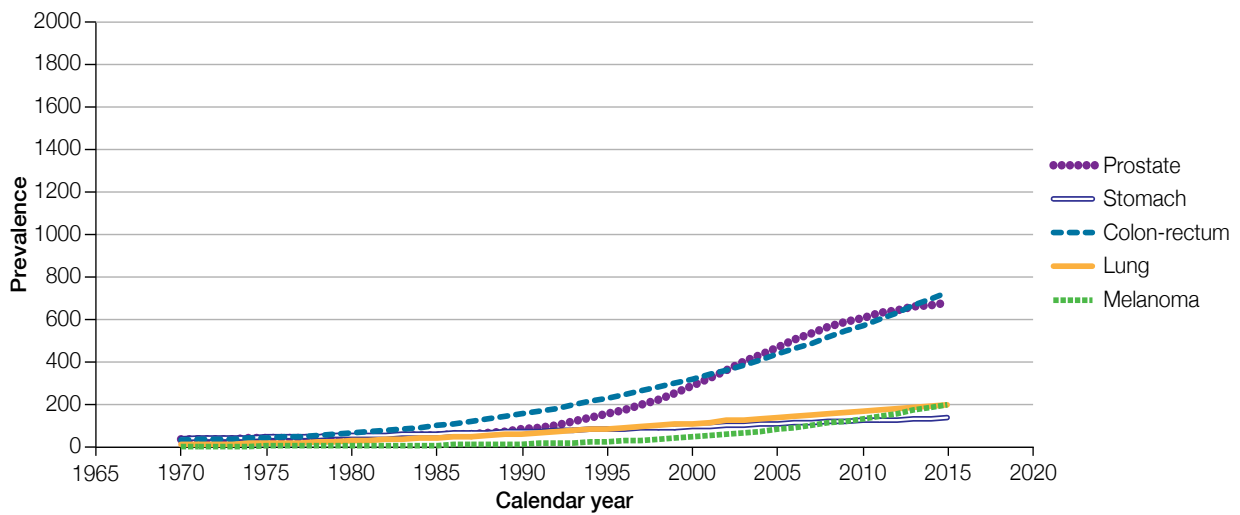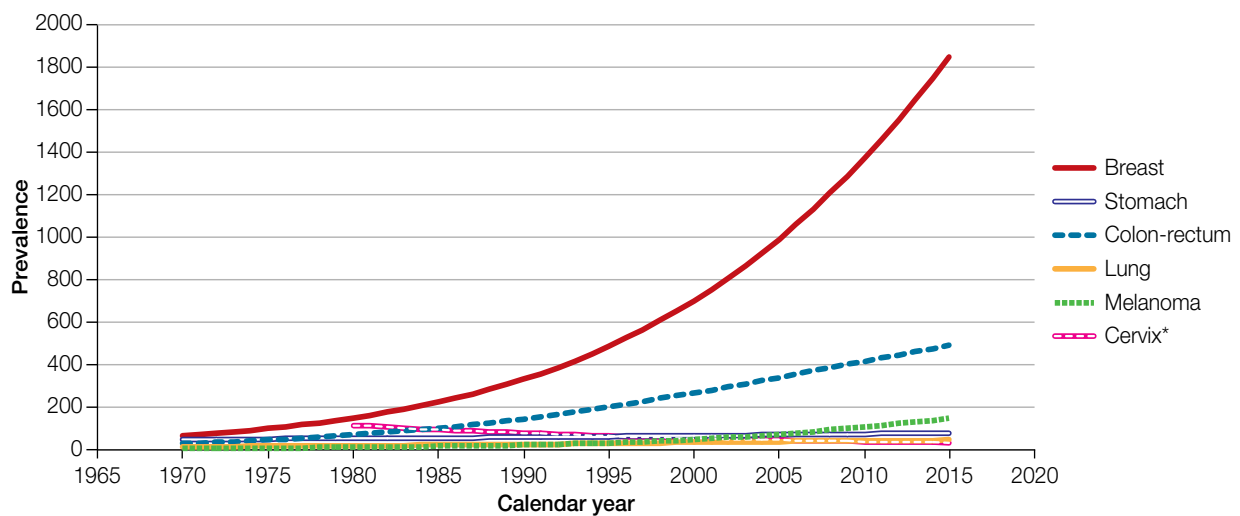

Figure 5 - Prevalence estimates by cancer site in Abruzzo and Molise in the period 1970-2015. Crude proportion per 100,000 persons. Age 0-99 years, men.

*limited-duration prevalence at 15 years

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

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