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Trends in cancer incidence and mortality in Italy, 2013–2017

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ABSTRACT

Cancer incidence and mortality trends represent epidemiological indicators of fundamental importance for public health systems. The study's aim is to present recent (2013–2017) short-term cancer incidence and mortality trends in Italy, including 80 % of the Italian population, for different cancer sites by sex, age group, and areas. Joinpoint Regression models were employed. A significantly decreasing trend in the incidence of all cancers was observed for men in Italy (-1.9 % per year), particularly for cancers of the lung (-2.5 %), liver (-3.9 %), stomach (-2.8 %), colorectal (-2.2 %), prostate (-3.4 %), and leukaemias (-3.2 %). The only significant increase was seen for skin melanoma (+5.2 % per year). Among women, overall cancer incidence remained stable, with a decrease in the North (-0.6 %) and an increase in the South and Islands (+0.9 %). Decreasing trends were observed for colorectal (-1.9 %), stomach (-3.5 %), liver (-4.0 %%), and leukaemias (-2.0 %) cancers, while incidence increased for skin melanoma (+6.0 % per year), and lung cancer (2.3 %). Cancer mortality declined consistently in both sexes (-1.8 % per year in men and −0.6 % in women), across different areas, and age groups. The observed trends in men and women partly reflect the impact of risk factors affecting both sexes at different times, mainly in the case of tobacco and lung cancer. Also, some trends may be linked to organized screening initiatives (e.g. colorectal) or the decrease in opportunistic screening (e.g. prostate). The snapshot of cancer trends in Italy may highlight new opportunities for strengthening prevention activities and advancing research on early detection and target treatments.

1. Introduction

Temporal trends in cancer incidence and mortality are key epidemiological indicators that can be appreciated and evaluated by different stakeholders, including patients, citizens, oncologists, and policymakers. These trends provide insights into the natural history of tumours and the impact of health system interventions. Changes in cancer incidence over time can help policymakers to assess the effects of shifts in cancer-related risk factors, identifying emerging risks or areas requiring targeted attention [1,2].

The progressive ageing of the Italian population is influencing cancer incidence trends. Given the increase in life expectancy and the lengthening of lifespan, the overall number of new cancer diagnoses will tend to increase over time. On the other hand, improving prognosis and advances in cancer treatment may impact cancer mortality, contributing to its general reduction [3].

The interpretation of a decreasing incidence is simple for primary prevention (i.e., avoiding unhealthy exposures and increasing healthy behaviours over previous decades) [4]. For some cancers (cervix uteri and colorectal cancer), secondary prevention also plays a role, when preinvasive lesions are detected and removed [5,6]. On the contrary, an increase in incidence may not only result from growing exposure to carcinogens but also an effect of early diagnosis in organised screening programmes [7]. Similar effects may be attained by the widespread diffusion of early diagnosis activities (e.g., prostate-specific antigen [PSA] testing for prostate, ultrasonography for thyroid cancer) [8,9].

The aim of this paper is to present short-term trends in cancer incidence and mortality in Italy during the period 2013–2017, using the largest and most representative cohort available from the AIRTUM network [10].

2. Methods

The data sources, methodologies, the quality consistency and completeness checks on Italian data are comprehensively detailed in a prior paper included in this supplement issue [11]. In brief, data were gathered from 34 population-based cancer registries (PBCRs) covering the period from 1981 to 2020 (variable among registries), including about 80 % of the Italian population and adhering to IARC guidelines for data comparability and criteria for incidence evaluation [12,13]. To allow the highest possible representativeness of the Italian population, the incidence and mortality analyses refer to the most recent available period (2013–2017) covered by all the PBCRs.

Cancer data were provided according to the International Classification of Diseases for Oncology (ICD-O-3) and subsequently recoded using the 10th revision of the International Classification of Diseases (ICD-10) [14,15].

Joinpoint Regression program were employed to analyze short-term annual trends in cancer incidence and mortality (2013–2017) and to estimate the annual percentage change (APC) for the linear trends fitted [16].

3. Results

3.1. Incidence

Annual variations of incidence (e.g. APC) were calculated for each site by sex, geographical macro-area (Table 1), and age group (Table 2). Only statistically significant APCs are shown in Fig. 1 and Fig. 2.

In Italy, among men, we observed increasing trends only for melanoma, while decreasing trends were noted for many cancers: stomach, larynx, colon, rectum, liver, lung, prostate, Central Nervous System (CNS), multiple myeloma, Chronic Lymphocytic Leukaemia (CLL), Chronic Myeloid Leukaemia (CML), leukemias, and for all cancers combined (including non-infiltrating bladder and excluding non-melanoma skin cancer). Among women, incidence trends increased for lung and melanoma, while decreasing for stomach, colon, rectum, liver, CLL, CML, and leukemias.

At the macro-area level, skin melanoma increased among women in all areas, while among men only in the Centre and South. Among women of the South, incidence increased for all tumours combined, as well as breast and kidney cancer. In the Centre we observed increases for lung cancer and Hodgkin Lymphoma (HL). In the North only Acute Lymphocytic Leukaemia (ALL) increased. Colorectal and ovary cancer incidence declined in the North and Centre, liver cancer decreased in the North and South and only in the North a decline was also observed for all tumours combined and thyroid cancer. In all three areas prostate cancer and all tumours decreased. Also, lung and stomach cancer incidence decreased in the North and Centre, colorectal cancer in the North and South, while CLL in the Centre and South. We also observed declines for liver, larynx and urinary tract cancers in the North as well as for CML, CNS, upper aerodigestive tract and pancreatic cancers in the Centre.

Among men, only skin melanoma in the 50–69 and 70 + age classes and testis cancer in the 50–69 class increased. Prostate and larynx cancer decreased in all age groups. In the two oldest classes we observed a decrease in CLL, CML, leukaemias, lung, stomach, liver, colorectal cancers, and also for all tumours. In the 50–69 age class, bladder (including non-infiltrating) and pancreatic cancer decreased, while in 70 + age class, multiple myeloma and kidney cancer also showed a decreasing trend. Among women, we observed a decrease in incidence for all age groups in stomach cancer, while skin melanoma increased. Significant increases were observed among younger women (0–49

Table 1
Annual percent changes (APCs) of age-standardized incidence rates and Confidence Interval (95 % CI) by cancer site and macro-areas for males (a) and females (b). Italy 2013–2017.

a) Males

Cancer Site	Italy APC (95 % CI)	North APC (95 % CI)	Centre APC (95 % CI)	South & Islands APC (95 % CI)
Upper aerodigestive tract	−1.6 (−3.3; 0.1)	−0.7 (−2.6; 1.1)	−2.3* (−4.6; −0.1)	−1.5 (−4.9; 2.1)
Stomach	−2.8* (−5.5; −0.2)	−2.9* (−4.8; −1.0)	−4.5* (−7.3; −1.9)	0.1 (−3.1; 3.5)
Colon-rectum	−2.2* (−3.4; −1.1)	−2.8* (−4.9; −0.9)	−2.5 (−5.1; 0.04)	−1.3* (−2.5; −0.1)
Colon	−1.9* (−3.5; −0.3)	−2.4* (−4.0; −0.8)	−1.8 (−4.5; 0.8)	−1.3 (−3.4; 0.8)
Rectum	−2.9* (−3.7; −2.0)	−3.7* (−6.0; −1.6)	−4.3* (−6.9; −1.5)	−1.4* (−2.6; −0.2)
Liver	−3.9* (−5.2; −2.6)	−4.1* (−6.5; −2.0)	−4.5 (−12.2; 3.5)	−2.8 (−5.7; 0.6)
Pancreas	−0.3 (−1.7; 1.1)	−0.2 (−1.0; 0.6)	−1.9* (−2.8; −1.0)	1.5 (−1.1; 4.2)
Larynx	−3.3* (−4.8; −2.0)	−3.9* (−6.8; −1.4)	−1.5 (−7.4; 4.5)	−4.0 (−11.6; 3.5)
Lung	−2.5* (−3.7; −1.4)	−3.1* (−3.7; −2.6)	−2.9* (−3.5; −2.2)	−1.4 (−3.5; 0.7)
Skin Melanoma	5.2* (2.5; 8.3)	2.9 (−2.3; 8.7)	8.8* (1.2; 17.4)	5.9* (4.8; 6.9)
Testis	1.5 (−0.4; 3.5)	1.5 (−4.7; 8.0)	2.5 (−4.8; 9.4)	1.7 (−1.0; 4.5)
Prostate	−3.4* (−4.4; −2.5)	−2.4* (−3.4; −1.4)	−7.1* (−7.9; −6.3)	−1.3* (−1.6; −1.0)
Kidney	−0.3 (−3.1; 2.5)	−0.1 (−3.2; 2.8)	−1.4 (−8.3; 5.9)	1.4 (−0.5; 3.3)
Urinary tract	0.2 (−3.2; 3.8)	−2.5* (−4.8; −0.4)	0.3 (−5.2; 5.9)	3.2 (−1.1; 7.6)
Bladder†	−2.0 (−4.1; 0.0)	−2.7* (−4.1; −1.4)	−2.0 (−4.4; 0.2)	−1.2 (−3.4; 0.8)
Central Nervous System (CNS)	−1.1* (−2.1; −0.1)	0.2 (−1.0; 1.2)	−4.6* (−7.9; −1.5)	0.5 (−2.1; 3.3)
Thyroid	−1.0 (−2.8; 0.8)	−1.1* (−1.7; −0.4)	−2.9 (−5.9; 0.3)	0.3 (−3.6; 4.5)
Hodgkin Lymphoma (HL)	−0.9 (−4.0; 2.2)	−2.1 (−7.7; 3.5)	−2.1 (−14.7; 11.5)	1.2 (−1.3; 3.8)
Non-Hodgkin Lymphoma (NHL)	−0.2 (−1.8; 1.4)	−0.3 (−3.0; 2.3)	0.7 (−1.5; 2.9)	−0.4 (−3.6; 2.9)
Multiple Myeloma	−1.0* (−1.9; −0.1)	−0.1 (−2.5; 2.0)	−1.6 (−11.9; 9.3)	−1.3 (−5.6; 3.1)
Acute Lymphocytic Leukaemia (ALL)	−1.3 (−3.5; 0.8)	−0.7 (−2.6; 1.2)	−5.8 (−15.9; 4.3)	−0.1 (−9.6; 8.0)
Chronic Lymphocytic Leukaemia (CLL)	−6.3* (−9.2; −2.5)	−5.6 (−11.6; 0.7)	−10.1* (−20.7; −1.1)	−3.7* (−6.4; −1.2)
Acute Myeloid Leukaemia (AML)	−3.1 (−6.4; 0.2)	−2.3 (−5.8; 1.1)	−9.8 (−21.6; 1.2)	4.5 (−5.4; 14.5)
Chronic Myeloid Leukaemia (CML)	−7.2* (−10.3; −4.4)	−7.5 (−19.8; 5.4)	−12.7* (−20.5; −1.4)	−4.0 (−9.5; 3.0)
Leukaemias	−3.2* (−4.7; −1.9)	−3.5 (−8.5; 1.8)	−3.9 (−12.4; 5.1)	−1.6 (−4.4; 1.2)
All Sites††	**−1.9* (−2.0; −1.9)**	**−2.1* (−2.6; −1.6)**	**−2.8*(−3.5; −2.1)**	**−0.9* (−1.2; −0.6)**

b) Females

Cancer Site	Italy APC (CI)	North APC (CI)	Centre APC (CI)	South & Islands APC (CI)
Upper aerodigestive tract	−0.4 (−3.0; 2.2)	−1.2 (−3.3; 1.0)	−0.5 (−8.2; 9.4)	1.7 (−0.4; 3.8)
Stomach	−3.5* (−5.4; −1.7)	−3.4 (−8.2; 1.0)	−5.3 (−12.3; 2.0)	−1.1 (−3.3; 1.1)
Colon-rectum	−1.9* (−2.3; −1.4)	−2.5* (−3.9; −1.1)	−2.2* (−3.6; −1.0)	−0.6 (−1.2; 0.1)
Colon	−1.5* (−2.4; −0.7)	−2.1* (−3.1; −1.1)	−1.4 (−5.1; 2.2)	−0.7 (−1.8; 0.5)
Rectum	−2.6* (−3.7; −1.6)	−3.6* (−6.0; −1.1)	−4.1* (−7.5; −0.8)	−0.4 (−2.8; 2.0)
Liver	−4.0* (−6.7; −1.5)	−3.5* (−6.4; −0.9)	−4.5 (−11.9; 2.6)	−4.3* (−7.6; −1.0)
Pancreas	0.8 (−1.5; 2.6)	0.9 (−3.0; 5.1)	−0.9 (−5.5; 3.8)	2.7 (−3.3; 9.2)
Larynx	0.0 (−11.9; 13.4)	−0.6 (−11.5; 11.2)	2.2 (−10.5; 16.1)	−3.6 (−10.5; 3.4)
Lung	2.3* (1.3; 3.2)	1.4 (0.0; 2.6)	2.9* (1.8; 4.0)	3.7 (−1.2; 8.6)
Skin Melanoma	6.4* (3.0; 9.5)	4.8* (1.1; 8.5)	8.6* (6.1; 11.2)	7.7* (4.0; 12.3)
Breast	0.6 (0.0; 1.2)	−0.3 (−0.8; 0.3)	1.1 (−1.9; 4.2)	1.7* (0.5; 2.8)
Cervix	−0.1 (−2.2; 2.0)	−0.7 (−2.5; 1.2)	0.8 (−2.8; 4.0)	0.6 (−2.1; 3.2)
Endometrium	−0.1 (−0.9; 0.7)	0.8(−0.5; 2.0)	−1.5 (−4.8; 1.9)	0.2 (−2.7; 3.1)
Ovary	−1.2 (−2.8; 0.4)	−0.9* (−1.8; −0.1)	−2.4* (−4.4; −0.5)	−0.3 (−2.7; 2.2)
Kidney	−0.6 (−2.5; 1.3)	−1.4 (−4.5; 1.7)	−3.0 (−6.5; 0.4)	4.1* (2.4; 6.0)
Urinary tract	0.3 (−10.2; 11.3)	1.2 (−7.0; 10.0)	−5.3 (−16.5; 11.8)	1.6 (−5.9; 9.6)
Bladder†	−0.2 (−3.1; 2.6)	−1.4 (−3.2; 0.3)	0.9 (−3.8; 6.2)	0.9 (−2.6; 4.4)
Central Nervous System (CNS)	−0.4 (−1.6; 0.7)	0.9 (−1.0; 2.8)	−1.6 (−11.4; 8.1)	−1.1 (−6.5; 4.3)
Thyroid	−2.2 (−4.5; 0.2)	−3.1* (−6.2; −0.3)	−3.9 (−8.5; 0.5)	0.2 (−7.6; 8.5)
Hodgkin Lymphoma (HL)	−0.1 (−2.3; 2.3)	−1.2 (−8.6; 6.5)	2.9* (2.8; 3.0)	−0.5 (−7.3; 6.8)
Non-Hodgkin Lymphoma (NHL)	−0.1 (−3.1; 2.3)	−0.7 (−3.2; 1.7)	0.2 (−2.0; 2.4)	0.3 (−3.8; 4.5)
Multiple Myeloma	−0.8 (−1.6; 0.1)	−0.1 (−2.7; 2.4)	−1.9 (−5.1; 1.4)	−0.8 (−4.6; 3.0)
Acute Lymphocytic Leukaemia (ALL)	0.0 (−3.5; 3.6)	6.9* (1.8; 12.6)	−4.0 (−17.4; 10.2)	−5.8 (−17.1; 5.0)
Chronic Lymphocytic Leukaemia (CLL)	−6.1* (−8.6; −3.9)	−3.9 (−11.1; 3.3)	−14.4 (−27.7; 0.3)	−2.8 (−7.8; 2.1)
Acute Myeloid Leukaemia (AML)	−2.0 (−10.5; 6.8)	1.7 (−2.8; 4.9)	−7.8 (−21.6; 5.1)	1.4 (−3.9; 7.1)
Chronic Myeloid Leukaemia (CML)	−8.0* (−16.1; −0.7)	−6.3 (−16.5; 3.4)	−11.1 (−27.7; 4.2)	−6.0 (−15.6; 3.3)
Leukaemias	−2.0* (−2.5; −1.5)	−0.9 (−3.8; 1.9)	−2.3 (−7.6; 2.9)	−3.4 (−7.0; 0.1)
All Sites††	**−0.1 (−0.6; 0.4)**	**−0.6* (−1.2; −0.04)**	**−0.1 (−1.1; 0.9)**	**0.9* (0.1; 1.6)**

*Statistically significant values
† including non-infiltrating cancers
†† including non-infiltrating bladder and excluding non-melanoma skin cancer

years) for breast, endometrial and kidney cancers, while lung cancer increased in the 70 + age group. We observed decreases in lung cancer among 0–49 women and for endometrial and CNS cancer among 50–69 women. In the two oldest classes we also observed a decline in CLL and colorectal cancer. Lastly, in the 70 + age class, cervix and liver cancer decreased.

For a more in-depth look, refer to the Fact Sheets for incidence and mortality in Supplementary materials.

3.2. Mortality

APCs and short-term mortality trends were calculated for all sites by sex, geographical macro-area (Table 3) and age group (Table 4). Statistically significant APCs are shown in Figs. 3 and 4.

Table 2
APCs of age-standardized incidence rates and Confidence Interval (95 %), by cancer site and age class, for males (a) and females (b). Italy 2013–2017.

a) Males			
Cancer Site	**0–49 years old APC (CI)**	**50–69 years old APC (CI)**	**70 + years old APC (CI)**
Upper aerodigestive tract	−1.4 (−6.7; 4.2)	−2.4 (−5.4; 0.4)	0.1 (−4.3; 4.4)
Stomach	−4.5 (−10.9; 1.6)	−3.5* (−5.6; −1.5)	−2.1* (−3.7; −0.6)
Colon-rectum	2.4 (−1.0; 6.1)	−2.7* (−3.4; −2.0)	−2.3* (−3.4; −1.1)
Colon	2.9 (−1.2; 6.1)	−2.4* (−4.3; −0.6)	−2.0* (−3.8; −0.1)
Rectum	−1.6 (−3.6; 0.4)	−3.4* (−4.7; −2.2)	−3.4* (−4.6; −2.1)
Liver	−5.4 (−15.0; 3.7)	−3.4* (−6.9; −0.0)	−3.9* (−5.7; −2.2)
Pancreas	2.3 (−6.6; 12.4)	−1.7* (−3.4; −0.0)	0.3 (−0.7; 1.3)
Larynx	−5.8* (−8.5; −3.4)	−4.3* (−5.6; −3.0)	−2.4* (−4.3; −0.6)
Lung	−3.6 (−9.3; 1.4)	−4.0* (−4.8; −3.2)	−1.6* (−2.4; −1.0)
Skin Melanoma	2.5 (−2.6; 6.8)	4.5* (1.4; 8.0)	7.4* (5.4; 9.6)
Testis	0.9 (−1.4; 3.2)	10.8* (8.4; 13.6)	4.8 (−1.3; 11.7)
Prostate	−8.8* (−15.3; −3.0)	−3.8* (−4.8; −2.9)	−3.1* (−3.7; −2.5)
Kidney	0.7 (−2.1; 3.8)	0.7 (−1.6; 2.8)	−1.5* (−3.0; −0.2)
Urinary tract	0.0 (0.0; 0.0)	−1.1 (−6.8; 4.8)	0.2 (−2.4; 2.8)
Bladder†	−1.3 (−10.7; 8.3)	−2.9*(−4.0; −2.0)	−1.6 (−3.9; 0.8)
Central Nervous System (CNS)	−1.3 (−8.0; 5.4)	−1.2 (−3.8; 1.3)	−1.1 (−3.0; 0.8)
Thyroid	−1.0 (−4.6; 26.0)	−2.3 (−6.6; 22.0)	1.5 (−6.2; 9.7)
Hodgkin Lymphoma (HL)	−1.8 (−5.6; 2.1)	0.2 (−10.1; 10.9)	0.4 (−10.9; 13.7)
Non-Hodgkin Lymphoma (NHL)	−1.5 (−7.2; 4.3)	−0.7 (−2.0; 0.4)	0.6 (−1.8; 3.0)
Multiple Myeloma	0.0 (−5.8; 6.1)	0.1 (−0.9; 1.1)	−1.7* (−2.5; −0.9)
Acute Lymphocytic Leukaemia (ALL)	−1.1 (−2.9; 0.7)	−3.8 (−16.2; 9.9)	−1.5 (−5.2; 2.3)
Chronic Lymphocytic Leukaemia (CLL)	0.0 (0.0; 0.0)	−7.2* (−12.6; −1.1)	−6.1* (−9.6; −2.8)
Acute Myeloid Leukaemia (AML)	−1.8 (−5.2; 1.5)	−1.9 (−7.9; 4.2)	−4.0 (−9.4; 1.3)
Chronic Myeloid Leukaemia (CML)	−1.8 (−11.4; 8.7)	−4.9* (−9.6; −0.6)	−11.3* (−16.0; −6.8)
Leukaemias	−1.4 (−3.8; 1.0)	−3.1* (−6.3; −0.2)	−3.6* (−4.4; −2.9)
All Sites††	−0.5 (−1.9; 0.9)	−2.6* (−3.1; −2.0)	−1.7* (−2.0; −1.4)
b) Females			
Cancer Site	**< 49 years old APC (CI)**	**50–69 years old APC (CI)**	**70 + years old APC (CI)**
Upper aerodigestive tract	5.2 (−3.0; 14.8)	−1.5 (−3.9; 0.8)	−0.4 (−1.8; 0.9)
Stomach	−7.2* (−9.4; −5.2)	−1.4* (−2.7; −0.2)	−3.9* (−6.2; −1.8)
Colon-rectum	−2.3 (−7.3; 2.5)	−2.5* (−3.6; −1.4)	−1.3* (−1.7; −1.0)
Colon	−0.6 (−4.6; 3.5)	−2.2* (−4.0; −0.6)	−1.1* (−1.9; −0.4)
Rectum	−1.9 (−6.8; 2.8)	−2.8* (−4.5; −0.9)	−2.4* (−3.2; −1.6)
Liver	−5.5 (−12.3; 0.8)	−5.4 (−12.1; 1.0)	−3.4* (−5.8; −1.0)
Pancreas	5.5 (−3.3; 15.9)	0.1 (−1.5; 1.9)	0.9 (−2.2; 3.9)
Larynx	0.0 (0.0; 0.0)	−0.6 (−7.6; 6.7)	0.1 (−3.6; 3.9)
Lung	−3.9* (−7.3; −0.7)	2.1 (−1.0; 5.4)	3.1* (1.6; 4.5)
Skin Melanoma	5.7* (3.0; 8.8)	6.4* (5.1; 7.7)	8.3* (1.7; 15.6)
Breast	0.8* (0.0; 1.6)	0.2 (−0.7; 1.1)	0.8 (−1.1; 2.7)
Cervix	1.8 (−1.0; 4.8)	−0.1 (−3.3; 3.2)	−3.5* (−5.5; −1.6)
Endometrium	1.5* (0.60; 2.2)	−1.0* (−1.8; −0.3)	1.1 (−2.1; 4.2)
Ovary	0.5 (−5.8; 7.0)	−1.2 (−3.6; 1.0)	−1.8 (−4.1; 0.4)
Kidney	1.5 (−1.8; 5.0)	−0.8 (−2.2; 0.5)	−0.9 (−2.7; 1.0)
Urinary tract	0.0 (0.0; 0.0)	−2.9 (−14.2; 9.0)	1.3 (−5.9; 9.1)
Bladder†	3.1 (−0.3; 6.9)	−0.4 (−3.7; 3.0)	−0.3 (−3.6; 3.0)
Central Nervous System (CNS)	1.4 (−4.7; 7.2)	−2.0* (−3.3; −0.9)	−0.1 (−5.9; 5.9)
Thyroid	−2.0 (−4.2; 0.0)	−2.7 (−5.6; 0.2)	−0.7 (−3.7; 2.3)
Hodgkin Lymphoma (HL)	−1.1 (−10.7; 9.4)	2.5 (−2.7; 8.2)	0.5 (−14.9; 15.4)
Non-Hodgkin Lymphoma (NHL)	−1.2 (−5.5; 3.2)	0.3 (−2.5; 2.9)	−0.7 (−4.2; 3.0)
Multiple Myeloma	−2.2 (−5.7; 1.3)	−0.4 (−6.9; 6.0)	−0.8 (−4.6; 2.8)
Acute Lymphocytic Leukaemia (ALL)	2.1 (−6.4; 11.7)	−9.1 (−22.7; 3.8)	−3.7 (−9.3; 1.9)
Chronic Lymphocytic Leukaemia (CLL)	0.0 (0.0; 0.0)	−4.3* (−8.3; −0.5)	−7.0* (−11.8; −2.7)
Acute Myeloid Leukaemia (AML)	−3.7 (−10.8; 3.3)	−2.3 (−10.6; 6.3)	−1.7 (−14.7; 11.8)
Chronic Myeloid Leukaemia (CML)	0.0 (0.0; 0.0)	−1.4 (−22.3; 25.2)	−9.0 (−33.3; 18.5)
Leukaemias	−1.6 (−3.8; 0.5)	−2.0 (−5.4; 1.3)	−2.3 (−5.8; 1.0)
All Sites††	0.3 (−0.2; 0.8)	−0.2 (−0.6; 0.1)	−0.1 (−0.9; 0.6)

*Statistically significance values
† including non-infiltrating cancers
†† including non-infiltrating bladder and excluding non-melanoma skin cancer

In Italy, among men, mortality trends increased only for kidney cancer, while decreasing trends were observed for cancers of the stomach, liver, lung, HL, AML, all leukemias, and all sites combined. Among women, mortality trends increased for upper aerodigestive tract, larynx, pancreas, lung, cervix, and urinary tract. In contrast, decreasing trends were noted for liver, CNS, thyroid, Non-Hodgkin Lymphoma (NHL), and all sites combined.

At macro-area level, among men, mortality increased for kidney cancer in the North and for testis cancer in the Centre. In all three areas mortality decreased for all tumours combined, stomach and lung cancers. ALL decreased in the North and Centre, liver cancer in the North and South. Leukaemias and CLL mortality decreased in the North, multiple myeloma mortality in the Centre and testis cancer mortality in the South. Among women, ASMR increased in all areas for lung and pancreatic cancers. In Northern Italy, mortality increased for larynx and upper aerodigestive cancers, the latter also in the South. Decreasing

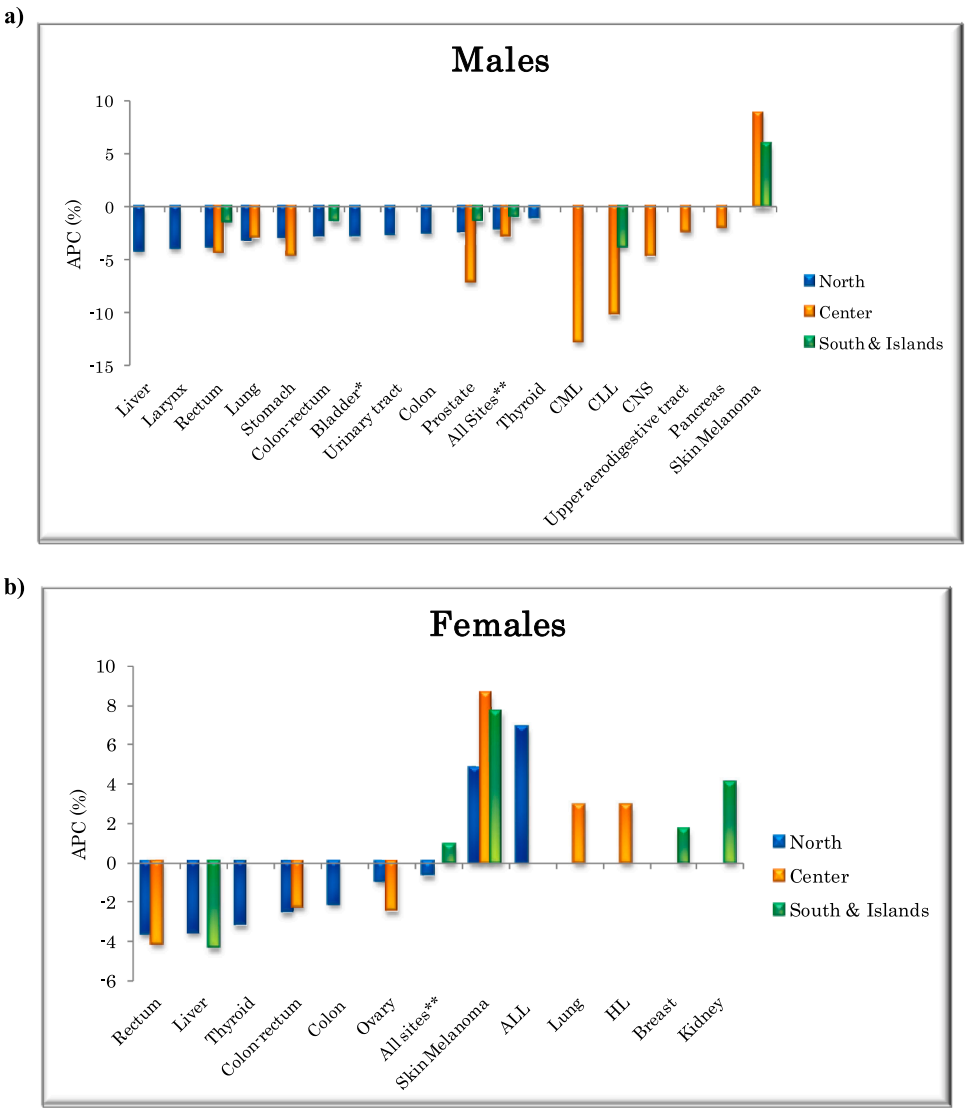

Fig. 1. Statistically significant APCs of age-standardized incidence rates, by macro-areas for males (a) and females (b). Italy 2013–2017. *including non-infiltrating cancers, ** including non-infiltrating bladder and excluding non-melanoma skin cancer, CML: Chronic Myeloid Leukaemia; CLL: Chronic Lymphocytic Leukaemia; CNS: Central Nervous System; ALL: Acute Lymphocytic Leukaemia; HL: Hodgkin Lymphoma.

mortality trends were observed for CLL and all tumours combined in the North and Centre, for liver cancer in the Centre and South and for thyroid cancer, Acute Myeloid Leukaemia (AML) and leukaemias in the North. Moreover, ALL and stomach cancer mortality decreased in the Centre, while CML in the South.

Among men, ASMR increased for CML in the 50–69 age group and for kidney cancer in 70 + group. However, mortality for all tumours combined decreased in all age classes. In young men (0–49 years) mortality for thyroid and testis cancer decreased. Also ALL and leukaemias mortality decreased in the two youngest classes. In 50–69 age class we observed a decrease for CLL, AML, NHL and colorectal cancer, while in 70 + class for liver cancer. Lung cancer decreased in both the 50–69 and 70 + age groups. Among women, ASMR increased for lung and urinary tract cancer in the two oldest groups. In 70 + age class ASMR increased also for breast, pancreatic and endometrial cancer. In the young women (0–49 years) we observed a decrease for multiple myeloma and stomach cancer, while in 70 + years group mortality declined for liver and thyroid cancers as well as all tumours combined.

4. Discussion

In Italy, during the period 2013–2017, overall cancer incidence (including non-infiltrating bladder and excluding non-melanoma skin cancer) declined in men and remained stable in women. However, a slight increase was observed among women living in Southern areas and a slight decrease in Northern areas. Mortality decreased more consistently in both sexes, and in all areas, and age groups.

Melanoma was the only cancer with an increasing incidence in both men and women. In particular, in women the incidence of this tumour increased in all areas and ages, while in men the increase was not significant in the North and among younger people. Mortality of melanoma was stable in Italy in both sexes, all areas, and all ages. Globally, a decrease in mortality has been estimated, with stable or increasing incidence rates, higher among women than men [17]. A key role in decreasing mortality could be played by increased awareness of risk factors, including UV radiation, earlier diagnosis, and improved treatments [17]. In Europe, increases in melanoma incidence have been observed in both sexes, and particularly in Denmark (period 1999–2011), the Netherlands (period 1989–2016), and Lithuania (period 1991–2015) [18–20]. In Sweden, a study evaluating trends in

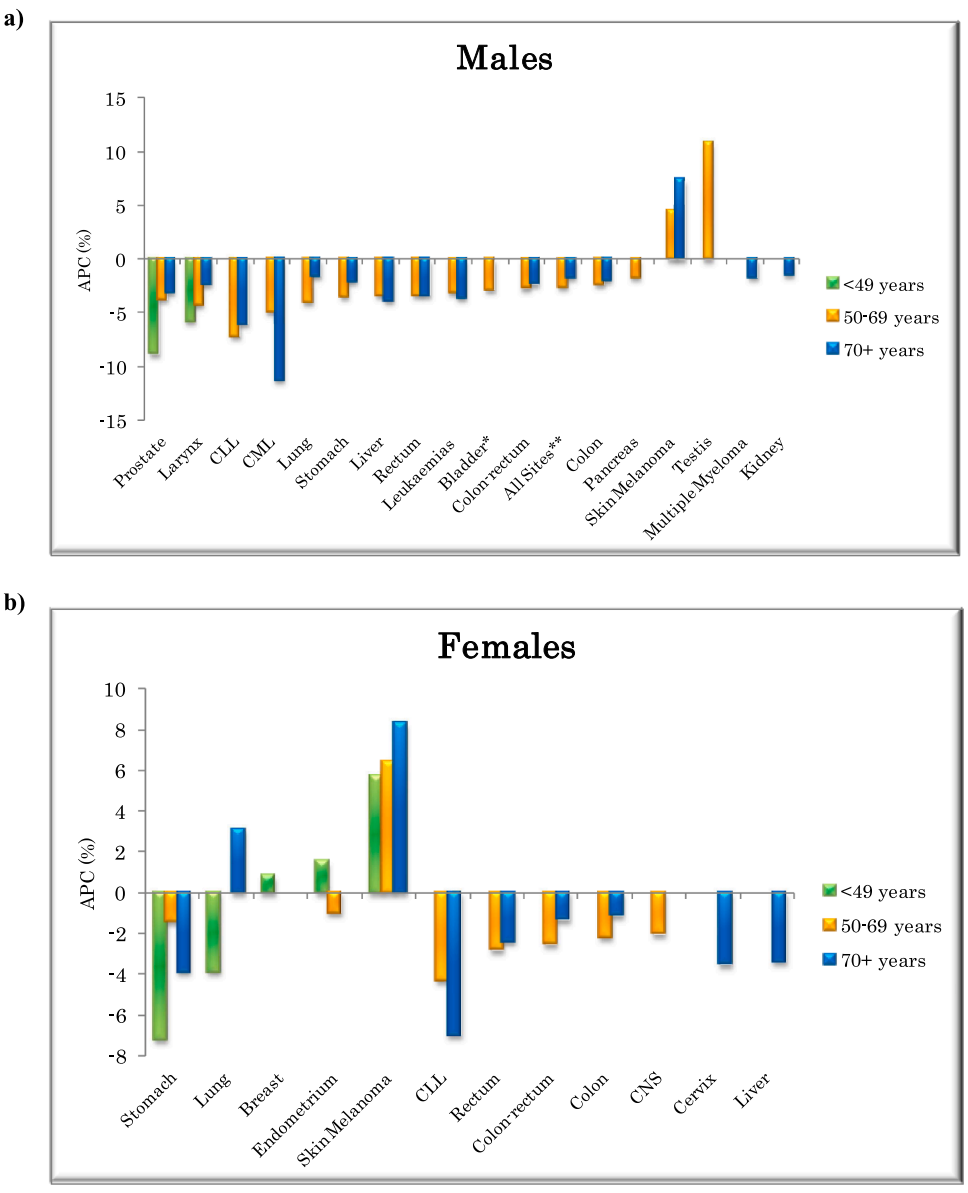

Fig. 2. Statistically significant APCs of age-standardized incidence rates, by age class for males (a) and females (b). Italy 2013–2017. *including non-infiltrating cancers, ** including non-infiltrating bladder and excluding non-melanoma skin cancer. CLL: Chronic Lymphocytic Leukaemia; CML: Chronic Myeloid Leukaemia; CNS: Central Nervous System.

individuals < 60 years old (period 1990–2022) showed an increase only for those aged 50–59 years old, while incidence declined between individuals aged 30 and 49 years old after peaking around 2014 alongside a decrease in mortality [21]. An Italian study also showed how increasing trends depend on birth cohorts, showing an inverse trend for people born after 1973 (women) and 1975 (men) [22]. Stratification by sex and age has also been proposed by Reinhart et al., to support the multifactorial nature of the increase in melanoma incidence (risk factors, UV exposure and sunbed use, the influence of sex hormones, and the possibility of overdiagnosis) [23]. Overdiagnosis has been considered a possible contributor to the observed increase in melanoma incidence [24,25].

Stomach cancer incidence has been decreasing in Italy in both sexes, in all ages among women and in the two oldest classes among men. Mortality among men has decreased in all areas of the country, while among women it decreased in the Centre and in people aged < 49 years old. Globally, a decreasing trend in stomach cancer incidence and mortality has been estimated, although certain areas still show increases, especially among individuals younger than 45 [26]. Lin et al. confirmed decreasing trends in both incidence and mortality in both sexes for Italy and most European countries [26]. Despite the decrease in gastric cancers, an Italian study suggested that some subtypes, particularly diffuse gastric cancer, would be increasing proportionally among young people, and mainly women [27]. This increase could be due to several factors including healthier behaviours (decrease in smoking habit,lower alcohol consumption, and decreased intake of salt-rich foods, etc.) that impact the burden of other types of gastric cancers, increasing the percentage of diffuse-type to the total [27].

Regarding colorectal cancer, incidence decreased in the period 2013–2017 in both sexes in the North, in women in the Centre and in men in the South and Islands. A significant decrease in incidence was observed in the two older age groups, with no substantial variation below age 50 years. Mortality showed a slight decline in both sexes. Recent analyses confirm a slight decrease in colorectal incidence among young adults aged 20–49 years in Italy (approximately 1 % per year in men and 2 % in women) considering the period 2008–2017 [28]. A

Table 3
APCs of age-standardized mortality rates and Confidence Interval (95 %), by cancer site and macro-areas for males (a) and females (b). Italy 2013–2017.

a) Males				
Cancer Site	**Italy APC (CI)**	**North APC (CI)**	**Centre APC (CI)**	**South & Islands APC (CI)**
Upper aerodigestive tract	1.1 (−3.3; 5.8)	0.3 (−6.2; 7.3)	3.9 (−1.5; 9.8)	0.6 (−2.6; 3.9)
Stomach	−2.4* (−3.2; −1.6)	−3.1* (−6.1; −0.1)	−2.3* (−3.9; −0.7)	−1.5* (−2.5; −0.5)
Colon-rectum	−0.5 (−2.7; 1.7)	−1.9 (−3.9; 0.1)	−0.5 (−1.5; 0.6)	1.4 (−0.7; 3.5)
Colon	−0.6 (−2.5; 1.4)	−2.4 (−5.0; 0.3)	−1.3* (−2.3; −0.3)	2.3* (0.1; 4.7)
Rectum	−0.4 (−1.9; 1.1)	−0.5 (−2.3; 1.3)	2.2 (−0.2; 4.7)	−2.1 (−7.2; 3.3)
Liver	−2.7* (−4.6; −0.8)	−3.2* (−5.9; −0.5)	−1.3 (−6.2; 3.9)	−2.9* (−3.9; −2.0)
Pancreas	0.9 (−1.4; 3.2)	−0.3 (−3.0; 2.4)	1.3 (−0.1; 2.7)	3.0 (−1.4; 7.8)
Larynx	−0.6 (−4.5; 3.4)	−0.8 (−6.7; 5.5)	−0.4 (−13.0; 14.3)	−0.4 (−3.3; 2.6)
Lung	−2.2* (−2.7; −1.7)	−2.9* (−4.0; −1.7)	−2.6* (−2.9; −2.2)	−1.2* (−1.7; −0.7)
Skin Melanoma	0.2 (−4.4; 4.9)	−1.0 (−5.6; 3.7)	0.3 (−5.6; 6.8)	2.5 (−5.6; 11.2)
Testis	−3.0 (−7.1; 1.0)	−3.9 (−15.3; 8.7)	10.7* (1.0; 22.9)	−8.2* (−13.8; −2.6)
Prostate	−0.8 (−2.4; 0.8)	−0.9 (−2.1; 0.3)	−1.7 (−5.5; 2.3)	−0.1 (−1.5; 1.3)
Kidney	2.3* (0.5; 4.2)	1.9* (0.2; 3.7)	0.9 (−4.8; 7.0)	4.5 (−1.6; 11.3)
Urinary tract	2.1 (−4.9; 9.8)	2.9 (−7.7; 15.0)	4.2 (−6.7; 16.8)	−1.6 (−8.0; 5.2)
Bladder†	0.7 (−2.4; 4.1)	0.6 (−3.0; 4.3)	1.5 (−2.2; 5.6)	0.6 (0.0; 1.2)
Central Nervous System (CNS)	0.4 (−2.0; 2.9)	0.3 (−3.2; 3.9)	−0.6 (−8.3; 7.5)	1.0 (−3.4; 5.8)
Thyroid	−3.3 (−8.0; 1.6)	−4.1 (−14.5; 7.5)	3.1 (−2.2; 8.9)	−6.2 (−15.1; 3.1)
Hodgkin Lymphoma (HL)	−2.6* (−4.4; −0.8)	−0.5 (−5.5; 4.6)	−4.9 (−9.7; 0.1)	−4.2 (−9.6; 1.2)
Non-Hodgkin Lymphoma (NHL)	−0.5 (−1.2; 0.1)	0.0 (−0.3; 0.3)	−1.0 (−6.1; 4.3)	−1.3 (−3.5; 0.9)
Multiple Myeloma	−0.5 (−3.0; 2.0)	−0.3 (−2.0; 1.5)	−1.7* (−2.7; −0.7)	−0.3 (−7.8; 7.6)
Acute Lymphocytic Leukaemia (ALL)	−4.7 (−11.0; 1.5)	−5.8* (−11.6; −0.0)	−5.0* (−10.1; −1.3)	−1.2 (−4.6; 1.1)
Chronic Lymphocytic Leukaemia (CLL)	−0.9 (−4.2; 2.5)	−2.6* (−3.9; −1.5)	−0.7 (−7.2; 6.6)	−0.4 (−2.3; 1.5)
Acute Myeloid Leukaemia (AML)	−1.7* (−3.2; −0.3)	−2.7 (−5.7; 0.3)	−1.0 (−3.6; 1.6)	−0.4 (−2.2; 1.2)
Chronic Myeloid Leukaemia (CML)	2.6 (−10.0; 18.1)	−2.0 (−12.5; 10.8)	−9.1 (−19.0; 1.1)	−3.3 (−19.3; 15.7)
Leukaemias	−1.1* (−2.1; −0.1)	−2.8* (−5.1; −0.6)	−0.9 (−4.2; 2.5)	1.2 (−1.9; 4.6)
All Sites††	−1.8* (−1.9; −1.6)	−2.3* (−2.6; −2.0)	−1.8* (−2.3; −1.2)	−1.0* (−1.3; −0.7)
b) Females				
Cancer Site	**Italy APC (CI)**	**North APC (CI)**	**Centre APC (CI)**	**South & Islands APC (CI)**
Upper aerodigestive tract	4.1* (1.8; 6.5)	4.6* (2.8; 6.4)	3.7 (−1.6; 9.6)	3.4* (1.8; 5.1)
Stomach	−2.2 (−4.7; 0.2)	−1.8 (−4.1; 0.5)	−2.9* (−5.5; −0.2)	−2.5 (−7.3; 2.6)
Colon-rectum	−0.6 (−2.3; 1.1)	−1.2 (−2.5; 0.1)	−1.3 (−6.2; 3.9)	0.7 (−1.5; 2.8)
Colon	−0.7 (−2.5; 1.1)	−1.4 (−3.5; 0.7)	−1.2 (−7.1; 5.0)	0.5 (−0.6; 1.7)
Rectum	−0.3 (−2.2; 1.5)	−0.7 (−3.0; 1.6)	−1.6 (−5.8; 2.6)	1.2 (−2.5; 5.0)
Liver	−3.0* (−5.2; −0.8)	−2.9 (−9.7; 4.5)	−2.3* (−4.6; −0.1)	−3.6* (−5.9; −1.3)
Pancreas	2.0* (1.0; 3.0)	1.5* (0.5; 2.5)	2.2* (0.5; 3.8)	2.8* (0.7; 5.0)
Larynx	3.1* (0.4; 6.0)	4.3* (0.2; 8.7)	0.4 (−17.4; 23.1)	3.7 (−8.4; 17.4)
Lung	1.8* (1.4; 2.3)	0.9* (0.6; 1.2)	2.7* (0.3; 5.2)	2.8* (1.3; 4.4)
Skin Melanoma	−0.3 (−8.9; 9.2)	−0.7 (−7.9; 7.0)	2.0 (−7.9; 13.2)	−1.8 (−5.5; 2.0)
Breast	0.4 (0.0; 0.9)	−0.2 (−0.9; 0.5)	1.3 (−1.2; 4.0)	0.9 (−0.5; 2.3)
Cervix	2.9* (0.0; 5.9)	4.4 (−6.8; 17.5)	4.3 (−2.0; 11.3)	−1.3 (−13.0; 11.5)
Endometrium	1.6 (−0.7; 3.9)	1.4 (−0.5; 3.4)	3.5 (−2.8; 10.5)	0.6 (−8.7; 10.8)
Ovary	−0.4 (−4.6; 4.1)	−1.6 (−5.0; 1.8)	−0.3 (−3.3; 2.8)	1.9 (−4.0; 8.3)
Kidney	−1.7 (−9.7; 7.0)	−3.5 (−8.5; 1.7)	−0.8 (−7.2; 6.0)	1.3 (−7.8; 11.7)
Urinary tract	6.6* (3.3; 10.2)	2.4 (−5.6; 11.1)	11.7 (−0.3; 27.0)	12.9 (−6.6; 39.0)
Bladder†	1.6 (−0.6; 3.8)	0.0 (−2.6; 2.8)	3.4 (−1.6; 8.9)	2.8 (−0.8; 6.8)
Central Nervous System (CNS)	−1.0* (−1.6; −0.4)	−0.9 (−3.6; 1.8)	−2.3 (−5.3; 0.8)	−0.5 (−1.4; 0.4)
Thyroid	−3.5* (−5.3; −1.8)	−3.3* (−6.0; −0.5)	−3.9 (−8.3; 0.6)	−3.2 (−7.0; 0.5)
Hodgkin Lymphoma (HL)	−4.2 (−12.4; 4.3)	1.5 (−11.6; 16.6)	−5.9 (−27.0; 18.0)	−10.7 (−24.0; 3.3)
Non-Hodgkin Lymphoma (NHL)	−1.2* (−1.8; −0.6)	−0.8 (−2.6; 1.0)	0.2 (−1.7; 2.1)	−2.7 (−6.6; 1.2)
Multiple Myeloma	−0.1 (−2.3; 2.1)	0.9 (−0.2; 2.0)	−4.6 (−11.2; 2.2)	1.1 (−4.6; 7.5)
Acute Lymphocytic Leukaemia (ALL)	−4.0 (−9.7; 1.6)	−1.0 (−4.5; 1.6)	−4.7* (−8.4; −1.4)	−6.0 (−15.6; 2.5)
Chronic Lymphocytic Leukaemia (CLL)	−0.5 (−5.7; 5.2)	−3.4* (−4.3; −2.8)	−2.3* (−3.9; −1.0)	−0.4 (−9.4; 10.1)
Acute Myeloid Leukaemia (AML)	−1.5 (−6.9; 3.9)	−2.8* (−4.7; −1.1)	−1.2 (−2.9; 0.5)	0.9 (−2.6; 4.1)
Chronic Myeloid Leukaemia (CML)	−0.4 (−8.8; 9.1)	−1.6 (−7.7; 5.0)	0.4 (−10.3; 12.1)	−4.3* (−7.9; −1.8)
Leukaemias	−1.0 (−2.9; 0.8)	−2.5* (−4.8; −0.3)	0.3 (−7.3; 8.5)	0.3 (−1.9; 2.6)
All Sites††	−0.6* (−0.9; −0.3)	−0.9* (−1.3; −0.6)	−0.4* (−0.6; −0.1)	−0.2 (−0.7; 0.3)

*Statistically significance values
† including non-infiltrating cancers
†† including non-infiltrating bladder and excluding non-melanoma skin cancer

study of data from Bavaria, Germany, revealed different trends in colorectal cancer incidence by histology and anatomical site in individuals under 50 years old. An increase was observed in neuroendocrine carcinomas of the appendix and rectum, while adenocarcinomas were stable (period 2005–2019) [29]. Among individuals over-50, adenocarcinomas decreased, whereas neuroendocrine tumours of the appendix and rectum increased, though to a lesser extent than in the under-50 [29].

Liver cancer incidence decreased in Italy in both sexes, particularly among subjects aged 70 + and in men 50–69 years old. Mortality also decreased in all areas among men, and in Central Italy and young females. In particular, hepatocellular cancers (HCC) has undergone significant changes in etiology, clinical presentation and treatment over the years. Between 2004 and 2018, Italy experienced a progressive increase in non-viral cases, mainly driven by metabolic and alcohol related causes [30].

Table 4
APCs of age-standardized mortality rates and Confidence Interval (95 %), by cancer site and age class, for males (a) and females (b) (mortality). Italy 2013–2017.

a) Males			
Cancer Site	**0–49 years old APC (CI)**	**50–69 years old APC (CI)**	**70 + years old APC (CI)**
Upper aerodigestive tract	−3.1 (−10.5; 4.4)	0.1 (−5.0; 5.5)	2.4 (−2.9; 8.0)
Stomach	−0.6 (−6.6; 5.5)	−2.8 (−5.7; 0.1)	−2.4 (−4.9; 0.1)
Colon-rectum	−1.7 (−8.4; 5.2)	−2.4* (−4.1; −0.6)	0.1 (−1.8; 2.1)
Colon	−3.1 (−6.5; 0.2)	−2.7* (−4.8; −0.7)	0.2 (−1.2; 1.6)
Rectum	1.9 (−3.7; 7.7)	−2.8* (−4.9; −0.7)	−1.3 (−3.5; 1.0)
Liver	−4.6 (−14.0; 4.9)	−2.7 (−6.8; 1.5)	−2.7* (−4.5; −0.9)
Pancreas	1.9 (−4.6; 8.6)	−0.4 (−2.3; 1.5)	1.5 (−1.9; 5.1)
Larynx	−5.2 (−21.4; 12.5)	−1.5 (−5.1; 2.1)	0.0 (−5.9; 6.5)
Lung	−2.9 (−8.6; 2.8)	−4.1* (−5.0; −3.2)	−1.5* (−2.6; −0.3)
Skin Melanoma	2.2 (−15.9; 24.2)	−4.6 (−14.6; 6.2)	2.5 (−1.8; 7.1)
Testis	−7.8* (−12.0; −3.8)	5.8 (−11.8; 28.8)	1.5 (−12.8; 19.2)
Prostate	−7.4 (−23.9; 10.2)	0.0 (−0.6; 0.7)	−0.9 (−2.5; 0.8)
Kidney	−3.6 (−10.2; 3.3)	1.5 (0.0; 3.1)	3.0* (1.8; 4.1)
Urinary tract	−7.0 (−44.6; 49.2)	−1.4 (−8.1; 5.5)	3.3 (−4.2; 11.7)
Bladder†	0.8 (−11.2; 14.7)	−0.9 (−2.0; 0.2)	1.0 (−2.4; 4.7)
Central Nervous System (CNS)	0.6 (−2.6; 3.6)	−1.2 (−6.1; 3.9)	1.9 (−2.9; 6.9)
Thyroid	−21.9* (−40.5; −6.1)	−6.2 (−13.4; 1.4)	−1.0 (−7.9; 6.2)
Hodgkin Lymphoma (HL)	−8.0 (−30.5; 17.6)	−0.2 (−19.9; 25.4)	−2.0 (−13.3; 10.7)
Non-Hodgkin Lymphoma (NHL)	11.0 (−13.2; 17.2)	−1.3* (−2.5; −0.0)	−0.4 (−1.3; 0.5)
Multiple Myeloma	3.2 (−13.9; 23.4)	−3.7 (−7.9; 0.5)	0.3 (−4.7; 5.6)
Acute Lymphocytic Leukaemia (ALL)	−7.4* (−14.7; −0.1)	−8.8* (−16.9; −0.7)	−0.2 (−10.7; 11.4)
Chronic Lymphocytic Leukaemia (CLL)	13.8 (−9.7; 48.6)	−7.7* (−13.5; −1.8)	0.0 (−5.6; 6.2)
Acute Myeloid Leukaemia (AML)	−6.1 (−22.8; 12.0)	−3.4* (−6.4; −0.4)	−0.7 (−2.3; 0.9)
Chronic Myeloid Leukaemia (CML)	29.1 (−20.8; 151.9)	16.4* (4.1; 33.0)	−0.1 (−14.0; 16.9)
Leukaemias	−4.9* (−9.4; −0.6)	−2.7* (−3.5; −1.9)	−0.4 (−2.8; 2.1)
All Sites††	−2.0* (−4.0; −0.1)	−3.0* (−3.5; −2.4)	−1.3* (−1.7; −1.0)
b) Females			
Cancer Site	**< 49 years old APC (CI)**	**50–69 years old APC (CI)**	**> 69 years old APC (CI)**
Upper aerodigestive tract	3.0 (−2.7; 8.9)	3.3 (−1.1; 8.0)	4.7* (2.6; 6.8)
Stomach	−7.0* (−10.9; −3.2)	−1.3 (−5.3; 2.6)	−2.3 (−4.8; 0.2)
Colon-rectum	−4.5 (−16.1; 7.3)	−0.3 (−1.9; 1.4)	−0.6 (−1.4; 0.3)
Colon	−6.2*(−12.0; −0.6)	−0.9 (−2.8; 1.0)	−0.4 (−1.4; 0.6)
Rectum	−0.1 (−9.1; 9.3)	−0.9 (−5.5; 4.0)	−1.5 (−3.3; 0.3)
Liver	−1.3 (−4.7; 2.1)	−1.4 (−6.5; 3.9)	−3.5* (−5.0; −2.1)
Pancreas	3.9 (−2.7; 11.3)	1.3 (−0.2; 2.7)	2.2* (0.8; 3.6)
Larynx	6.4 (−40.8; 105.8)	−0.9 (−6.4; 4.7)	5.9* (2.6; 9.4)
Lung	−3.8 (−8.4; 0.8)	1.2* (0.1; 2.3)	2.6* (1.8; 3.4)
Skin Melanoma	1.6 (−9.6; 13.7)	−3.5 (−16.4; 10.8)	1.0 (−2.9; 5.1)
Breast	−1.1 (−8.4; 6.6)	−0.9 (−4.9; 3.2)	1.5* (0.4; 2.7)
Cervix	2.8 (−7.4; 14.3)	1.6 (−0.6; 3.9)	3.7 (−5.2; 13.6)
Endometrium	4.4 (−28.9; 52.8)	−0.6 (−3.7; 2.5)	2.8* (0.1; 5.5)
Ovary	1.4 (−8.5; 12.0)	−1.4 (−6.7; 4.1)	0.3 (−4.0; 4.8)
Kidney	4.8 (−24.7; 49.5)	−4.4 (−14.2; 6.2)	−1.0 (−5.0; 3.2)
Urinary tract	8.7 (−20.1; 48.8)	9.2* (4.8; 14.4)	5.7* (2.0; 10.3)
Bladder†	−3.4 (−31.7; 36.0)	3.3 (−0.5; 7.4)	1.3 (−3.8; 6.8)
Central Nervous System (CNS)	−1.7 (−4.2; 0.7)	−1.4 (−2.9; 0.2)	−0.8 (−2.4; 0.8)
Thyroid	−17.3 (−40.3; 9.5)	−2.7 (−14.1; 10.3)	−3.1* (−4.8; −1.4)
Hodgkin Lymphoma (HL)	−16.6 (−35.5; 1.7)	2.0 (−12.5; 19.3)	−1.7 (−11.6; 9.1)
Non-Hodgkin Lymphoma (NHL)	−8.2 (−18.6; 2.1)	−0.7 (−6.0; 4.9)	−0.7 (−2.2; 0.8)
Multiple Myeloma	−9.4* (−18.5; −0.5)	−2.0 (−6.4; 2.6)	0.6 (−3.7; 5.3)
Acute Lymphocytic Leukaemia (ALL)	−6.0 (−14.7; 2.6)	−3.9 (−23.8; 19.4)	−4.6 (−13.1; 4.1)
Chronic Lymphocytic Leukaemia (CLL)	0.0 (0.0; 0.0)	−8.0 (−16.7; 0.9)	0.6 (−4.6; 6.1)
Acute Myeloid Leukaemia (AML)	−5.8 (−16.7; 5.8)	−2.6 (−5.5; 0.3)	−0.1 (−4.6; 4.4)
Chronic Myeloid Leukaemia (CML)	−24.1 (−74.8; 66.8)	−13.1 (−31.7; 6.7)	2.5 (−3.7; 9.4)
Leukaemias	−6.3 (−15.4; 2.8)	−1.7 (−4.1; 0.8)	−0.2 (−1.8; 1.5)
All Sites††	−2.0 (−4.7; 0.6)	−1.0 (−2.5; 0.4)	−0.3* (−0.5; −0.0)

*Statistically significance values
† including non-infiltrating cancers
†† including non-infiltrating bladder and excluding non-melanoma skin cancer

Lung cancer and other smoking-related cancers (i.e., upper aerodigestive tract and larynx) exhibited different trends between men and women. Among men, incidence was decreasing, particularly in the North and Centre, while among women, incidence was increasing especially in the Centre. Moreover, age-specific trends emphasize these differences: lung cancer incidence decreased in all age classes in men, and in younger women, while, in older women, the increase was more marked with increasing age. In addition, male mortality decreased in all areas and in the two oldest age classes, while among women mortality increased in all areas and in the two oldest age classes. Similar trends have been observed in Switzerland between 1980 and 2018, and in Nordic countries (Denmark, Finland, Sweden, and Norway) [31,32]. A study showed a decrease in mortality trends between 2000 and 2017 in North America, in EU and in the European Free Trade Associations (EFTA) countries: in particular, there was a decrease in almost all countries for men, while among women mortality increased in many

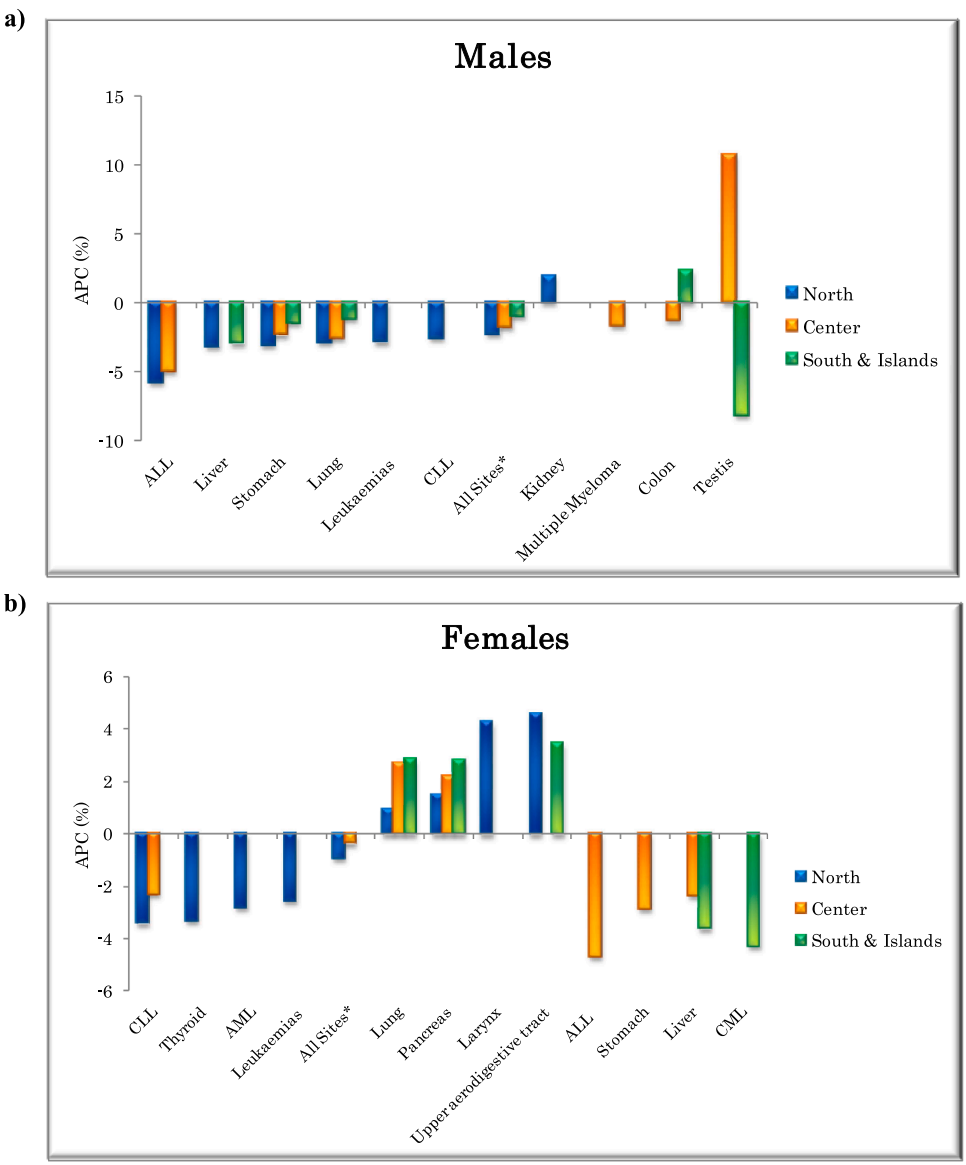

Fig. 3. Statistically significant APCs of age-standardized mortality rates, by macro-areas for males (a) and females (b). Italy 2013–2017. *including non-infiltrating bladder and excluding non-melanoma skin cancer, ALL: Acute Lymphocytic Leukaemia; CLL: Chronic Lymphocytic Leukaemia; AML: Acute Myeloid Leukaemia; CML: Chronic Myeloid Leukaemia.

countries with the exception of the US. The highest increase in female lung cancer mortality were in Spain and France, with Italy ranking fifth among Southern Europe [33]. In Spain, mortality among men decreased over the period from 1996 to 2021, while among women it increased from 1982 to 2021 [34]. A recent Italian study, including death in the period 1995–2016, showed that the peak mortality in men was reached by the cohort born between 1920 and 1929, while for women it was the court born between 1955 and 1964 [35]. The differences between the sexes have long been associated with a different smoking epidemic, with men starting earlier and women being affected later [32,36,37]. Our findings support the need for stronger tobacco control strategies to achieve the tobacco endgame [38].

For breast cancer, incidence increased in the South and among young women 0–49. In an in-depth study of cancers in young adults (20–49 years) in Italy, a 5 % increase in breast cancer incidence between 2008 and 2017 was reported [28].

Prostate cancer incidence in Italy decreased in all areas and age groups while mortality remained stable. A similar result was observed in Girona, Spain, where a 25-year study (1994–2018) showed a reduction in incidence since 2003, and a continuous decline in mortality over the entire period [39]. Decreases in incidence and mortality have been reported in many regions of the world, particularly in high-income countries, which could reflect a decrease in prostate-specific antigen (PSA) testing and improved treatment [40]. The study by Vaccarella et al., which analysed incidence and mortality data from 26 European countries (1980–2017) for men 35–84 years, showed the overdiagnosis in characterising the epidemiology. The study suggests different PSA testing levels across periods contributed to these different trends in Europe [41].

In both sexes, leukaemias decreased significantly. In men this decrease was particularly evident in the two oldest classes. Leukaemia mortality also decreased among men, in the North in both sexes and in the two youngest classes for men. A decrease in incidence trends in both sexes was seen also in the Czech Republic during 2009–2018 [36]. At the subtype level, we observed a significant decrease in incidence in both sexes for CLL and CML, while incidence of ALL has increased in women. Mortality for CLL has decreased in both sexes in the North and in women in the Center. Mortality for CML has decreased among women in South

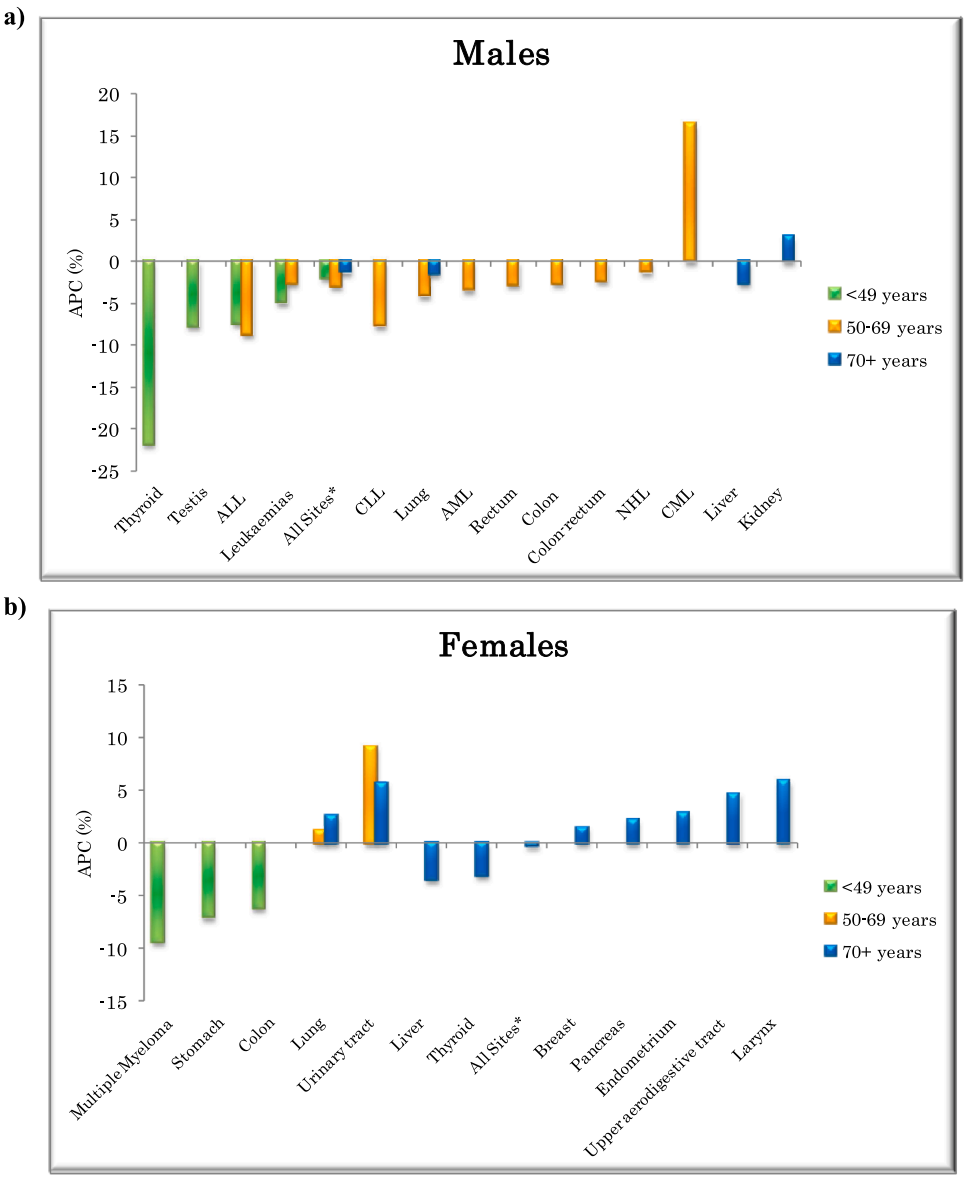

Fig. 4. Statistically significant APCs of age-standardized mortality rates, by age class for males (a) and females (b). Italy 2013–2017. * including non-infiltrating bladder and excluding non-melanoma skin cancer. ALL: Acute Lymphocytic Leukaemia; CLL: Chronic Lymphocytic Leukaemia; AML: Acute Myeloid Leukaemia; NHL: Non-Hodgkin Lymphoma; CML: Chronic Myeloid Leukaemia.

and Islands. ALL mortality has decreased in the Centre for both sexes, and among men in the North. Mortality for AML has decreased for both men and women in the North. Decreasing trends in incidence and mortality for leukaemias have been documented in many countries, including European ones [42]. Factors attributable to this decrease may include an advancement in therapies, reduced exposure to environmental risk factors and smoking, a decrease in childhood leukaemias, increased intake of folate and vitamins during pregnancy, and increased screening for high-risk genetic mutations [42]. However, in some high-developed countries, including Germany and the United Kingdom, there are increasing incidence trends that could also be due to increased diagnostic capacity. On the contrary, in less developed countries increases in mortality have been showed and could be related to a greater exposure to risk factors and limited access to up-to-date therapies in these regions [42].

The strengths of this study include the large number of cases collected by PBCRs and the high quality of data provided by the AIRTUM network. One of the main limitations is represented by the short period analysed in the trends due to the temporal misalignment of incidence covered by PBCRs data. Another limitation is the lack of data from areas not covered by PBCRs or from registries that did not participate in this study, particularly from the Northern part of the Country. However, the study included 80 % of the Italian population with a representativeness higher than any other previous publication. Finally, mortality rates may be less accurate than incidence rates because of possible inaccuracies in medical certification and codification [43]. However, assuming substantial homogeneity in the classification of cause of death (plausible when using a common data source as in the present project) a decrease in cancer-specific mortality represents a positive message.

5. Conclusion

The study showed decreasing trends for several types of cancer, particularly among men. However, we also observed increasing trends for other types of cancer, which could be potential targets for cancer prevention programs. The decrease in cancer incidence among men may be parlty due to a reduction in the tobacco epidemic, an effect that is now more pronounced in the female population. Additionally,

prevention initiatives should increasingly focus on promoting healthy lifestyles, particularly healthy nutrition and physical activity. The observed decrease in mortality trends, on the other hand, may also be related to improved diagnosis and treatment. However, we have also showed some increasing trends that highlight the need to promote research into early diagnosis and new targeted treatments. Neverthless, mortality trends follow those of incidence in accordance with models that show how the main contributors to the reduction of mortality are primary prevention and screening programs [44].

CRediT authorship contribution statement

Viviana Perotti: Writing – original draft, Methodology, Data curation, Conceptualization. **Andrea Tittarelli:** Writing – original draft, Methodology, Data curation, Conceptualization. **Paolo Contiero:** Writing – original draft, Supervision, Methodology, Data curation, Conceptualization. **Luigino Dal Maso:** Writing – original draft, Supervision, Methodology. **Maria Teresa Pesce:** Writing – original draft, Supervision. **Maurizio Zarcone:** Methodology, Data curation. **Alessio Gili:** Methodology, Data curation. **Walter Mazzucco:** Writing – review & editing, Supervision, Project administration. **Fabrizio Stracci:** Writing – review & editing, Supervision, Project administration. **Emanuele Crocetti:** Writing – review & editing. **Sabrina Fabiano:** Writing – original draft, Supervision, Methodology, Data curation, Conceptualization.

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Declaration of Competing Interest

None to be declared.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.canep.2025.102855.

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