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Use of SERTS (Socio-Economic, health Resources and Technologic Supplies) models to estimate cancer survival at provincial geographical level

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ABSTRACT

Aim: The main aim of this work is to compute expected cancer survival for Italian provinces by Socio-Economic and health Resources and Technologic Supplies (SERTS) models, based on demographic, socioeconomic variables and information describing the health care system (SEH).
Methods: Five-year age-standardised relative survival rates by gender for 11 cancer sites and all cancers combined of patients diagnosed in 1995–1999, were obtained from the Italian Association of Cancer Registries (CRs) database. The SEH variables describe at provincial level macro-economy, demography, labour market, health resources in 1995–2005. A principal components factor analysis was applied to the SEH variables to control their strong mutual correlation. For every considered cancer site, linear regression models were estimated considering the 5-RS% as dependent variable and the principal components factors of the SEH variables as independent variables.
Results: The model composition was correlated to the characteristics of take in charge of patients. SEH factors were correlated with the observed survival for all cancer combined and colon-rectum in both sexes, prostate, kidney and non Hodgkin's lymphomas in men, breast, corpus uteri and melanoma in women (R^2 from 40% to 85%). In the provinces without any CR the survival was very similar with that of neighbouring provinces with analogous social, economic and health characteristics.
Conclusions: The SERTS models allowed us to interpret the survival outcome of oncologic patients with respect to the role of the socio-economic and health related system characteristics, stressing how the peculiarities of the take in charge at the province level could address the decisions regarding the allocation of resources.

1. Introduction

The AIRTUM network (Italian association of cancer registries) produces in Italy the observed epidemiological indexes on cancer occurrence and survival for the area where cancer registration is active [1–4], while the corresponding regional and national estimates are computed, by using different methods, principally by the National Centre of Epidemiology, Surveillance and Promotion of Health (CNEPS) of the National Institute of Health, the National Cancer Institute (INT) and the International Agency for Research on Cancer (IARC) [5,6].

The last AIRTUM monograph on cancer survival in Italy studied the prognosis of patients diagnosed in the period 1995–2002 [2]; it collected data from 22 Cancer Registries (CRs) belonging to 14 Italian regions. During this period only 28% of the population (about 16 millions of subjects) was covered by CR monitoring. They were principally located in Northern-Central areas of the country, while five of the six regions uncovered were located in the South and, among the eleven regions only partially covered, four were located in the South and Islands [1,2]. Therefore the monitored population was not a random sample representative of the entire country [2]. We know that generally the areas covered by CR activity are more affluent (Fig. 1), with a better organisation of their local health system. Generally, the Northern-Central areas are more affluent than the Southern and Islands ones, and the epidemiological indexes observed by CRs showed a North to

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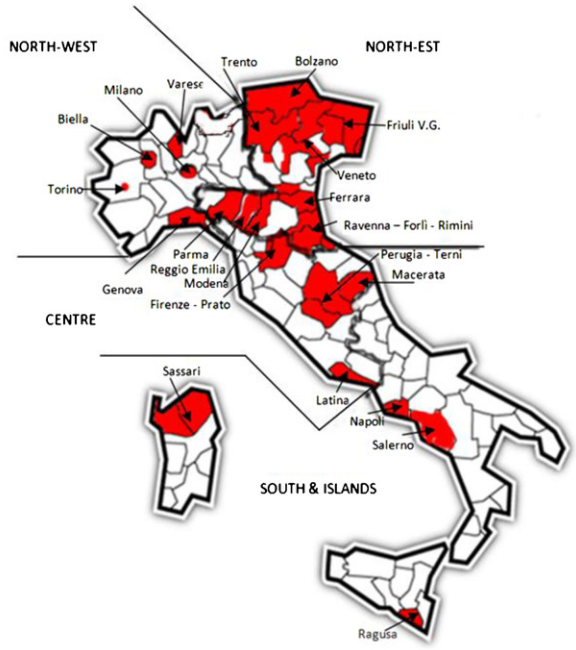
Yearly observed population in the period 1995-2002: 16,063,217
CR's coverage: 28.2%



Italian AAV = 21,133 €
Mean CR areas AAV = 22,848 €

(euro-per-capita)

Regional coverage (%), CR areas (provinces) and their population (coverage %) and Average Added Value (AAV, euro-per-capita)

Regional coverage (%)	Areas	Population covered	AAV
NORTH- WEST (26.8%)			
Piemonte (25.0%)	Biella	187,282 (100%)	22,323 €
	Turin (city)	865,263 (100%)	24,058 €
Valle d'Aosta (0%)	-	-	-
Lombardia (22.9%)	Milan (city)	1,256,211 (100%)	32,904 €
	Varese	811,445 (100%)	23,850 €
Liguria (55.9%)	Genoa	879,965 (100%)	22,310 €
NORTH-EAST (65.2%)			
Trentino - A. A. (100%)	Bolzano	462,154 (100%)	27,217 €
	Trento	475,835 (100%)	25,055 €
Friuli V.G. (100%)	Pordenone	285,090 (100%)	24,707 €
	Udine	518,465 (100%)	22,732 €
	Gorizia	136,420 (100%)	21,680 €
	Trieste	242,447 (100%)	24,758 €
Veneto (44.3%)	Verona	300,399 (36.3%)	25,447 €
	Vicenza	418,245 (52.7%)	25,598 €
	Belluno	209,549 (100%)	24,196 €
	Treviso	499,561 (62.8%)	24,610 €
	Venezia	404,951 (50.0%)	24,503 €
	Rovigo	170,000 (70.1%)	20,989 €
Emilia-Romagna (70.4%)	Parma	392,864 (100%)	26,990 €
	Reggio-Emilia	452,194 (100%)	26,655 €
	Modena	632,508 (100%)	27,532 €
	Ferrara	344,568 (100%)	21,545 €
	Ravenna	347,432 (100%)	24,303 €
	Forlì	357,473 (100%)	24,338 €
	Rimini	271,674 (100%)	23,215 €
CENTRE (25.5%)			
Toscana (33.2%)	Firenze	933,969 (100%)	26,663 €
	Prato	227,830 (100%)	23,928 €
Umbria (100%)	Perugia	605,336 (100%)	20,428 €
	Terni	219,856 (100%)	18,413 €
Marche (20.5%)	Macerata	301,141 (100%)	20,086 €
Lazio (9.6%)	La ina	491,532 (100%)	18,429 €
SOUTH & ISLANDS(11.5%)			
Abruzzo (0%)	-	-	-
Molise (0%)	-	-	-
Campania (28.3%)	ASL4-Napoli	538,335 (100%)	13,620 €
	Salerno	1,074,152 (100%)	13,710 €
Puglia (0%)	-		-
Basilicata (0%)	-		-
Calabria (0%)	-		-
Sicilia (5.9%)	Ragusa	295,360 (100%)	14,801 €
Sardegna (27.8%)	Sassari	453,711 (100%)	15,231 €

Fig. 1. Italian regions, provinces and Cancer Registries (CRs) coverage, and average added value by area.

South gradient in cancer survival [5,7–9] Furthermore, in the recent years the organisation of health care system in Italy has changed towards different regional models, so the take in charge of cancer patients tends also to differ across the regions.

The population coverage by cancer registration has recently increased in Italy, particularly in the South and Islands. However, the long time that until now has been necessary (for instance the one required by the whole Italian CRs to produce high quality incidence data and to perform the patients' follow-up), still strongly asks us to provide health planners and policy makers with estimates of cancer survival at regional and provincial level, in order to assess the priorities in the care management and control preventive and curative programmes.

The association between cancer survival, socioeconomic status, demographic indicators and medical resources was found by several authors [10–16]. Making use of this relationship, this work is aimed at estimating cancer survival at the provincial level, by means of models based on demographic and Socio-Economic variables and indicators describing the Health care system (SEH variables). The provincial level was chosen because generally it geographically corresponds to the local health unit level (ASL) of the National Health System organisation, the small simultaneously administrative and operative level of the take in charge of the patients.

The available resources at ASL level are decided at the immediately higher regional level, which should operate a correct allocation of them among their ASLs with respect to the needs of the population: thus, the latter can only optimise the use of the resources provided for their functioning.

In this way the expected relative survival at the province level will become a good programming tool to improve the regional performance in terms of survival and, with some limit, they could contribute to assess the efficacy of the allocation of the resources.

Moreover, also the area covered by the CR generally corresponds to the provincial territory. Thus the simultaneous availability of the expected survival computed by the models and of the observed survival from CR can strongly contribute to the monitoring and control, in the ASLs in which a registry is operating, of the effectiveness of the cancer patient take in charge. Such a kind of model could be applied to other countries with a similar territorial administrative division and a partial coverage of cancer patients monitoring.