Methods and Indicators

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INCIDENCE

Is the amount of new cases of cancer that occur in a defined population (e.g. the residents in the city of Turin) in a determined period; such measure expresses the risk of becoming ill in the population.

MORTALITY

Indicates the amount of deceased cases for a disease (e.g. for the cancer of the lung, for all sites, etc.) in the observed population and in an interval time. Although the Piedmont Cancer Registry collects death certificates of the Piedmont population and runs the regional mortality registry, these mortality figures are based on ISTAT files for wider comparability.

NUMBER OF CASES

Total number of registered cases for the period or for one year (annual).

$$N = \sum_{i} \mathrm{n}_{i}$$

where n_i =number of cases in the period by age group
i = index for five-year age group

AGE SPECIFIC RATES

Rates are annual, per 100,000 inhabitants. They result from the ratio between the number of cases in five-year age group and the resident population in the corresponding group.

$$R_i = \frac{n_i}{p_i} \times 100,000$$

where n_i = number of cases by age groups
p_i = population by age groups

RATE PER CASE

The Rate per Case (RPC) for each age-group is the inverse of the population figure (1/population) for the sex and age-group, but multiplied by 100,000 and divided by the number of years included in the period of review. It is given in order to facilitate recovery of the actual number of cases contributing in the numerator to a given figure of incidence or mortality. For example, if we have a incidence rate of 12.3 for breast tumour in females aged 25-29, for which the RPC is 1.22698, it results from 10 cases in this category (12.3/1.22698). For larger rates, the calculation may be less accurate because the RPC is quoted only to a limited number of decimals.

CRUDE RATES

Rates are annual, per 100,000 inhabitants. The crude rate results from the ratio between the average annual number of cases registered in the period and the estimate of the resident population in the area of the Registry for that same period.

$$Crude\ Rate = \left[\frac{\sum_i n_i}{\sum_i p_i} \right] \times 100{,}000$$

where n_i = number of cases by age groups

p_i = population by age groups

GEOGRAPHICAL COMPARISONS IN SUB-AREAS

The observed provincial area is further divided in administrative sub-areas (ASL – Local Health Authorities) where health care is organized and delivered. We proposed comparisons across those sub-areas for incidence and mortality in tables and figures. Since the low frequency for some neoplasm and the limited population size for some sub-areas, we included 95% confidence interval in figures for a quick appreciation of true differences, excluding variations due to statistical instability.

Survival indicators, for their intrinsic higher statistical sensibility to sample size, were excluded from sub-areas geographical comparisons.

Analysis of smaller areas would require more complex statistical methods to control for statistical instability, inter-border variations and time-space patterns. Specific studies dealing with geographical pattern of risk in Piedmont and in Italy are published separately and their references can be found in the CPO website section dedicated to publications.

STANDARDIZED RATES

Rates are annual, per 100,000 inhabitants, age-standardized by the direct method. When the disease is strongly correlated to age, such as in the case of cancer, the value of the crude rate is influenced by the true intensity of the phenomenon and by the proportion of elderly individuals in the observed population. Since the proportion of elderly subjects may vary to a great degree, comparisons between crude rates are biased. To solve this problem, the age standardization is used: this consists of applying the age specific rates of the observed population to the age distribution of a standard population (direct method). The result may be considered as a rate which would be obtained in the standard population if incidence (mortality) were that of the observed population. As standards, we used the European standard (EU27+EFTA 2013), a new standard defined by Eurostat in 2013 more adherent to the observed crude rates in European populations, and the World standard populations for across-the-world comparisons.

$$Rstd = \frac{\sum_i (R_i \times ps_i)}{\sum_i ps_i}$$

where ps_i = standard population by age groups

SURVIVAL

Survival measures time that elapsed from the date of the diagnosis to the date of relapse or death and expresses the proportion of incident cases that survive to successive anniversaries from diagnosis date. In the case of survival of incident cases occurred in a resident population of a defined geographic area, as survival measured by cancer registries, it can be said that it measures the effectiveness of the health system in the reference population. Ideally, one would only consider the clinical evolution of the disease, independently from other conditions. This problem is solved in clinical studies excluding those cases in which the cause of death is not from the disease evolution but it is attributable to other concurrent disease (specific survival). This is not feasible in population studies, and it is a source of possible bias also in the clinical ones. Therefore, a demographic correction is applied; it consists of subtracting the general mortality observed for all the causes to the observed mortality in the studied group. Survival values, after this correction are called relative survival and they make possible comparisons between populations and groups with different general mortality patterns show. Indicators in tables (observed and relative survival) are percentage of persons still alive at 1, 5, 10 and 15 years from diagnosis. The first series of survival data presents results from the most recent cases, while the second series shows results from all cases registered since 1985 (longer follow-up).

In this analysis, we excluded DCO (Death Certificate Only) cases and cases younger than 15 years of age. With the aim of presenting the most up-to-date figures, we included also those most recent years of incidence with a follow-up time lesser than five years. This results in a less robust estimates, but more sensible to the recent survival improvements achieved in recent years.

OBSERVED SURVIVAL

Observed survival (Sj) has been calculated according to the actuarial method as the product, until the follow up time (1, 5, 10 or 15 years), of the survivals in single time intervals, that is**:**

$$S_j = p_1 \cdot p_2 \cdot p_3 \cdot \ldots \cdot p_{i-1} = \prod_{i=1}^{i-1} p_i$$

where:

j= 1, 3, 5, 10, 15 years

p_i is the survival in the time interval (a month) estimated as:

$$p_i = \left(1 - \frac{d_i}{l_i^{'}}\right)$$

where:

$\frac{d_i}{l_i^{'}}$ is the conditional probability that a subject dies in the interval of time i, since he/she survived until that time;

l_i’ is the effective number of patients at risk in the time interval i and d_i is the number of deaths in the same interval.

RELATIVE SURVIVAL

In order to eliminate the effect of competitive mortality, that is the mortality due to other causes, and, therefore, to estimate the effect of a single cancer on the patient survival, it is used the relative survival (R_j), here calculated according to the Pohar-Perme method. It is the ratio between the observed survival (S_j) and the expected survival if the studied group had experienced the same mortality for all causes as the general population (S_j*), obviously taking into consideration those characteristics that can influence general mortality, such as sex, age, race, period of observation and geographic area.

$$R_j = \left(\frac{S_j}{S_j^*} \right) \times 100$$

Age-standardized relative survival is a method used to compare survivals with different composition by age. Patients were divided in age groups; at each age group was given a weight (according to “Corazziari et al, European Journal of Cancer, 2004”). Relative survival was then calculated for each age group and standardized survival is the result of the sum of the weighted age-specific relative survival.

PREVALENCE

The prevalence of cancer is the number of patients diagnosed with cancer present in the reference population. In the case of the city of Turin, prevalence is the total number of patients with a given cancer diagnosed since the 1985 (year when cancer registration started in Turin population), and still alive. In the case of the rest of the Piedmont region, where populations were observed for a shorter interval of time, we estimated an “**overall**” prevalence that included also all those patients not observed in the patients set, but presumably still alive and present in the actual populations. Prevalence indicators are expressed as number of cases per 100,000 in the reference population.