

HOSPITALIZATIONS

Data source

Hospitalization data are elaborated by the Unit of Statistics of Istituto Superiore di Sanità on the basis of official data released by the Italian Ministry of Health (hospital discharge records) along with demographic data provided by the Institute of Statistics (Istat). The national hospital discharge records database assigns each patient a unique anonymous code that allows to follow every hospital of the same patient access throughout the national territory and for all the years available.

A certain number (sharply declining in recent years) of patients is not identified by the above mentioned code: hospitalizations related to those patients were not considered in the estimate. Since the aim here is to describe health profiles through the occurrence of pathologies, the analysis concerns the set of acute hospitalizations: that is, long-term hospitalizations and rehabilitations were not included.

Hospitalization diagnoses are classified through an internationally acknowledged system called ICD-9 CM (International Classification of Diseases - Clinical Modification), in use in Italy where the latest version of 2007 was adopted starting from January 1, 2009. Each hospital discharge record reports a "main diagnosis" and up to five "secondary diagnoses"; only the main diagnosis is examined here.

In order to reconstruct hospitalizations/inpatients at local health unit level, the "correspondence municipality vs local health units" was used.

Hospital admissions

The analysis concerns hospitalizations for acute cases in the ordinary regime, and day-hospitalizations for local health units; hospitalization diagnosis was sought only in the main diagnosis.

Inpatients

For each chosen diagnosis, the first hospitalization in the selected period is taken into consideration. It should be noted that the extraction of the first admission concerns patients belonging to Italian local health units during the time period under consideration; a patient who has changed residence (therefore local health unit) during the period under consideration, will be counted in each local health unit of residence. Besides, national data will not take into account the aforementioned changes of residence.

Selected diagnoses

In order to render the most informative local health unit profile in terms of hospitalizations, 34 specific diagnoses were selected in addition to hospitalization for all natural causes (excluding complications of pregnancy, childbirth and puerperium). These diagnoses include, in addition to the large groups of pathologies, single causes such as acute myocardial infarction within the group of the circulatory system diseases. The complete list of selected causes is shown in the table below.

Hospitalization breakdown diagram for all diagnoses: a graphical representation, in total and by gender, of the breakdown for hospitalization diagnoses is provided. Single age classes are reported on the X-axis, admissions in absolute values on the Y-axis.

Average age at hospital admission specific for hospitalization diagnosis (calculated for hospitalizations and inpatients): the formula is as follows:

$$\bar{x} = \frac{\sum(x + \frac{1}{2}n) * h_x}{\sum h_x}$$

Specific rate by age groups (calculated for hospitalizations and inpatients): the specific rate is a frequency ratio and indicates how many hospitalizations/inpatients are there in the age group (x,x+i) during an established time interval (year, period) for every 100,000 individuals averagely present in the population, in the same age group, observed for each selected cause. For each selected diagnosis the absolute value of hospitalization/inpatients, the specific rate for age group and the confidence interval of the rate are shown in total and by gender, and by five-year age groups. The specific rate confidence interval is calculated at 95%, and used to evaluate the accuracy of the estimate made. The formula of the specific rate in the age group x,x+I, is as follows :

$$T_{x,x+i} = \frac{h_{(x,x+i)}}{P_{(x,x+i)}} \times 100.000$$

The formula for confidence intervals follows these algorithms:

$h_{(x,x+i)} = 0$:

$$Lim_{inf} = 0$$

$$Lim_{sup} = \frac{-\ln(\alpha)}{P_{(x,x+i)}} \times 100.000$$

- $0 < h_{(x,x+i)} < 100$:

$$Lim_{inf} = \frac{inv\Gamma_{(\alpha/2, h_{(x,x+i)})}}{P_{(x,x+i)}} \times 100.000$$

$$Lim_{sup} = \frac{inv\Gamma_{(1-\alpha/2, h_{(x,x+i)}+1)}}{P_{(x,x+i)}} \times 100.000$$

Where $inv\Gamma_{(p,a)}$ is the inverted gamma function that provides the p -th quantile from a gamma distribution with parameter of form a .

- $h_{(x,x+i)} > 100$:

$$Lim_{inf,sup} = T_{(x,x+i)} \pm Z_{\alpha/2} \frac{\sqrt{h_{(x,x+i)}}}{P_{(x,x+i)}} \times 100.000$$

Standardized rate for hospitalizations/inpatients for all ages and for the age groups 0-14,15-64, 65-74 and +75 years (calculated for hospitalizations and inpatients): the standardization technique is used to neutralize the effects of the different age structures of Local Health Units' populations and to allow comparisons among different populations. (eg: local health unit rate → Italy rate). The method used for standardization is “direct”, as the specific rates of the studied populations are weighed with the “Standard Europe 2013” population; all the populations studied are attributed an identical age structure, which does not interfere on the intensity of the studied phenomenon.

The formula of the standardized rate, always expressed per 100,000 is:

$$T_{std} = \sum_x \frac{h_{(x,x+i)}}{P_{(x,x+i)}} w_{(x,x+i)}$$

where $w_{(x,x+i)}$ is the proportion of the Standard European Population in the age layer $x, x+i$.

The formula for confidence intervals follows these algorithms:

defined v the variance of T_{std} :

$$v = \sum h_{(x,x+i)} \left(\frac{w}{P_{(x,x+i)}} \right)^2$$

and w_ω the maximum value of $\frac{w_{(x,x+i)}}{P_{(x,x+i)}}$

we have:

$$Lim_{inf} = \frac{v}{2T_{std}} (\chi^2)^{-1} \left(\alpha/2, \frac{2T_{std}^2}{v} \right) \times 100.000$$

$$Lim_{sup} = \frac{v + w_\omega^2}{2(T_{std} + w_\omega)} (\chi^2)^{-1} \left(1-\alpha/2, \frac{2(T_{std} + w_\omega)^2}{v + w_\omega} \right) \times 100.000$$

where $(\chi^2)^{-1}_{(a,b)}$ is the inverse distribution of the chi square on level a , with b degrees of liberty.

Interregional mobility – Escape index

The escape index quantifies the propensity of the population to move away from their local health unit/Region to be cured. It is calculated as the ratio between the number of hospital discharges of patients outside their local health unit/Region (in the rest of the national territory) and the total hospitalizations of residents in the same local health unit/Region carried out throughout the national territory.

Table. Selected hospital discharge diagnosis and related ICD9-CM codes

Diagnosis	ICD9-CM codes
All natural causes (excluding complications of pregnancy, childbirth and puerperium)	001-629,677-799
Infectious and parasitic diseases	001-139
All malignant tumors	140-208
Malignant tumor of the stomach	151
Malignant colorectal tumor	153-154
Primary malignant tumor of the liver and intrahepatic bile ducts	155
Malignant tumor of the pancreas	157
Malignant tumor of trachea, bronchi and lung	162
Malignant breast tumor (F)	174
Malignant tumor of the uterus (F)	179-180, 182
Malignant prostate tumor (M)	185
Malignant tumor of the bladder	188
Malignant tumor of the central nervous system	191-192
Malignant tumor of the thyroid gland	193
Malignant tumor of the lymphohematopoietic system	200-208
Leukemia	204-208
Endocrine diseases	240-259
Diabetes mellitus	250
Dementias	290.0, 290.4, 331.0- 331.2
Diseases of the nervous system	330-349
Parkinson's disease	332.0
Circulatory system disease	390-459
Ischemic heart disease	410-414
Acute myocardial infarction	410
Cerebrovascular diseases	430-438
Respiratory diseases	460-519
Acute respiratory diseases	460-466, 480-487
Chronic respiratory diseases	490-492,494,496
Asthma	493
Digestive tract diseases	520-579
Chronic liver diseases	571
Diseases of the genito-urinary system	580-629
Acute and chronic renal failure	584-586
Congenital malformations	740-759
Trauma and poisoning	800-999

Data confidentiality

In order to ensure respect for the confidentiality of personal data concerning health, only aggregated data (frequencies greater than or equal to the minimum threshold of three) are displayed, as indicated in the art.5 of the "Code of ethics and good conduct for the processing of personal data for statistical and scientific purposes".

In the Tables, frequencies below this threshold are indicated with "<3"; the corresponding rates are indicated with "-".

Essential bibliography

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