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Hospitalization for ambulatory care sensitive conditions and the role of primary care in Italian regions

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Abstract

Background: Hospitalization may often be prevented by timely and effective outpatient care either by preventing the onset of an illness, controlling an acute illness or managing a chronic disease with an appropriate follow-up. The objective of the study is to examine the variability of hospital admissions within Italian regions for Ambulatory Care Sensitive Conditions (ACSCs), and their relationship with primary care supply.

Methods: Hospital discharge data aggregated at a regional level collected in 2005 were analysed by type of ACS conditions. Main outcome measures were regional hospital admission rates for ACSCs. Negative binomial models were used to analyse the association with individual risk factors (age and gender) and regional risk factors (propensity to hospitalisation and prevalence of specific conditions).

Non-parametric correlation indexes between standardised hospital admission rates and quantitative measures of primary care services were calculated.

Results: ACSC admissions accounted for 6.6% of total admissions, 35.7% were classified as acute conditions and 64.3% as chronic conditions. Admission rates for ACSCs varied widely across Italian regions with different patterns for chronic and acute conditions. Southern regions showed significantly higher rates for chronic conditions and North-eastern regions for acute conditions. We found a significant negative association between the provision of ambulatory specialist services and standardised hospitalization rates (SHR) for ACS chronic conditions (r=-0.50; p=0.02) and an inverse correlation among SHR for ACS acute conditions and the rate of GPs per 1,000 residents, although the latter was not statistically significant.

Conclusions: In Italy, about 480,000 inpatient hospital admissions in 2005 were attributable to ACSCs. Even adjusting for potential confounders, differences in hospital admissions for ACSCs among Italian regions were found. Such differences can be appropriately used to assess the effectiveness and/or appropriateness of the primary care provided within different regions.

Key words: ambulatory care sensitive conditions, ACSC, avoidable hospitalisation, primary care

Introduction

Italy, like most other industrialized countries, faces a wide range of health-care challenges. Rising health-care costs and the resulting efforts to control spending have added pressure to an already burdened health-care system to deliver more services with less finances. Research suggests that efficient primary care is able to shift patients with Ambulatory Care Sensitive Conditions (ACSCs) away from inpatient settings [1-4]. These hospitalizations can be avoided when clinicians deliver timely and effective outpatient treatment to individuals who actively participate in their own care [5].

ACSCs are said to represent a range of conditions that could be treated in a primary care setting (i.e., a GP's office or a community health clinic), provided that individuals are able to access these facilities at the appropriate time and the appropriate care is prescribed [6]. Consequently, in any given geographic area, the expectation is that avoidable hospitalizations should be lower where people are receiving the appropriate primary care in substitute.

Conversely, in areas where availability and/or access to primary care is more limited, rates of avoidable hospitalizations tend to be higher [7]. Hospitalization may often be avoided by timely and effective outpatient care either by: a) preventing the onset of an illness or condition b) controlling an acute episodic illness or condition or c) managing a chronic disease or condition.

Table 1. List of Ambulatory Care Sensitive Conditions (ACSCs): definitions, codes and exclusions .

ACSCs by group	*ICD-9-CM codes*	*Exclusion*
Group 1 Conditions preventable through early diagnosis and treatment		
A1: Nutritional deficiency	260, 261, 262, 268.0, 268.1	
A2: Disorders of hydro-electrolyte metabolism	276.5, 276.8	
A3: Pneumonia	481, 482.2, 482.3, 482.9, 483, 485, 486	Excluded cases with sickle cell anaemia (282.6) as secondary diagnosis
A4: Bleeding of perforating ulcers	531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6	
A5: Appendicitis with complications	540.0, 540.1	
A6: Urinary tract infections	590.0-590.9, 595.0, 595.9, 599.0	
A7: Pelvic inflammatory disease	614	
Group 2 Treatable conditions through good ongoing, control and management		
B1: Diabetes	250.0-250.9, 251.0, 785.4 + 250.7	
B2: Amputation of lower limbs in patients with diabetes	84.10-84.19 + 250.0-250.9	Excluding amputation for trauma (895, 896,897)
B3: Hypertension	401.0, 402.0, 403.0, 404.0, 405.0, 437.2	Excluding cases with cardiac surgical procedures (35, 36, 37.31-37.35, 37.5-37-54, 37.7-37.8, 37.94-37.98)
B4: Angina pectoris	413	Excluding cases with cardiac surgical procedures (35, 36, 37.31-37.35, 37.5-37-54, 37.7-37.8, 37.94-37.98)
B5: Heart failure	428, 518.4	Excluding cases with cardiac surgical procedures (35, 36, 37.31-37.35, 37.5-37-54, 37.7-37.8, 37.94-37.98)
B6: Asthma	493	

Hospitalization for ACS conditions, also known as potentially avoidable hospitalization, has been proposed as an indirect indicator of the accessibility and overall effectiveness of primary health care.

In a previous study, important preliminary results showed that in Italy, nearly half a million inpatient admissions in 2005 involved treatment for one or more of these ACSCs, resulting in a total cost of approximately € 1.5 billion, at least part of which could have been saved [8]. Thus, high rates of hospitalizations for these conditions indicate potential opportunities for improving the health system's effectiveness and efficiency.

A previous study, regarding hospitalization in southern regions of Italy, showed that the proportion of patients who had a preventable hospitalization was significantly higher in areas with higher general admission rates, and in areas with a higher number of patients per primary care physician [9]. In Spain important variations in the accessibility of primary care are observed in spite of there being a universal health system [10]. Earlier studies on general practice in London showed that hospital admission rates were associated with a prevalence of chronic illness and deprivation [11].

Thus, the propensity to use the hospital setting, the presence of GPs in the territory, the socio-economic conditions and the epidemiology of chronic conditions, as well as the availability of hospital beds are recognized as explanatory factors for hospitalization for ACSCs. GPs have a key role in preventing hospitalizations by following up patients, prescribing appropriate drugs and specialist visits and by applying EBM methods.

Following the constitutional reform approved in 2001 (Constitutional law n. 3/2001) the 21 Italian regions and autonomous provinces have exclusive managerial competence in the field of health care. For this reason, investigations at a regional level are of special interest when evaluating the health service's performance in Italy.

The objective of this study is to examine the variability among the Italian regions in hospital admissions in adults for ACSCs, distinguishing the role played by acute and chronic components, whilst taking into account the influence of epidemiological factors, health care delivery patterns as well as patients' own features. We also investigated the relationship between hospitalization rates for ACSCs and quantitative measures of primary care supply at a regional level.

Methods

ACSCs definition

ACSCs are generally defined as conditions where appropriate ambulatory care may prevent or reduce the need for hospitalization [12].

We used the principal diagnosis for each hospitalization, coded according to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD9-CM) of diagnosis and procedures, to identify the admissions for the set of ACSCs. The criteria adopted to select the ACSCs were those defined by Pirani [13] who adapted the original criteria defined by Weissman [14] to the Italian context.

The set was limited to the conditions selected for adults and was classified by the strategy of prevention (conditions preventable through early diagnosis and treatment, or conditions treatable through good ongoing care, control and management). The conditions together with their definitions and coding are listed in Table 1.

Data

Information on hospital discharges that occurred in 2005 was extracted from the Hospital Discharge Register (HDR) of the Ministry of Health in anonymous format. The HDR is a register of all hospitalization episodes, which includes administrative and clinical data that all public and private hospitals are required to report. We used hospitalizations in public and contracted hospitals, which represent 96% of all hospitalisations. Day hospital and day surgery admissions were not considered at this stage of the development of our study. In this study, we considered discharges from acute hospitals among adults (over 18 years) for ACSCs, selected on the basis of the ICD9-CM code of the main diagnosis. We extracted patient information regarding age, gender and region of residence. Population characteristics were obtained from the statistics of the resident population supplied by the Institute of National Statistics (ISTAT) (in Italy in 2005: 59 million residents, among them 50.2 million aged 18 years or more). The analysis units were the 21 Italian regions and autonomous provinces.

Information on primary care consisted of the total number of general practitioners (GPs), the number of diagnostic services and visits in ambulatory care settings, and was obtained from the National Database for Primary Care [15].

Epidemiological data on specific conditions (diabetes and pneumonia) were drawn from the National Health Interview Survey on health conditions and recourse to health services [16] and from the archive of the Italian Institute of Health (ISS) on mortality [17] .

Statistical analysis

The hospitalization rate for ACSCs (ACSC-HR) is defined as the number of admissions for a particular ACSC (or a group of ACSCs) per population at risk in a given year. In this study ACSC-HR was expressed as the number of hospitalizations per 1,000 of the resident population. We considered total hospitalization rates (THRs), specific rates for acute conditions susceptible to early diagnosis and treatment (nutritional deficiencies, disorders of the hydro-electrolyte metabolism, pneumonia, bleeding of perforating ulcers, appendicitis with complications, urinary tract infections and pelvic inflammatory disease), and specific rates for chronic conditions susceptible to appropriate follow-up and management (diabetes, amputation of lower limbs in patients with diabetes, hypertension, angina pectoris, heart failure and asthma). Given that different prevention strategies are involved, acute and chronic conditions were analysed separately. Specific rates of hospitalisation for ACSCs by age, sex and region were described.

We analysed the association between the rates of hospitalization for ACS acute and chronic conditions respectively and some selected individual risk factors and contextual risk factors at regional level. Individual risk factors were the patient's age (categorized as <45, 45-64, 65-74, ≥75), sex and region of residence, and the Piedmont region, the one with overall lower rates, was used as a reference. The contextual risk factor considered in all the models was the "propensity" to hospitalization at regional level. We used a categorization of the rate of total hospitalization on the basis of quartiles of specific rates by age, sex and region. The propensity to hospitalization was considered as low (rate ≤ 25°percentile), medium (25°percentile <rate≤ 50° percentile), high (50°percentile < rate ≤ 75°percentile), very high (rate>75°percentile).

Further analyses were conducted considering the rates of hospitalization for two specific conditions, pneumonia and diabetes, selected because of their high incidence. In order to analyse hospitalization rates for pneumonia, an ecological variable was added to the model specified above: the regional mortality rate for pneumonia [17]. In the absence of data on the prevalence of the disease, mortality was used as a proxy. Mortality could also be a proxy of the severity of the disease, another recognized factor associated with the risk of hospitalisation. In order to analyze the risk of hospitalization for diabetes, the regional prevalence of the disease [16] was added to the model. Both the ecological variables, mortality and prevalence, were categorized as low, medium, high or very high. In these further analyses, the region of residence was categorized to represent a geographical partition which shares some common socio-economic characteristics, North-West, North-East, Centre, South and the Islands.

The appropriate model to analyse rates (count data) is the Poisson model [18]. Due to the spatial nature of our data and to the inclusion of "ecological" variables in the models, data could be affected by autocorrelation and an extra-Poisson variation. In order to deal with over-dispersion and autocorrelation, negative binomial models were used instead [19]. The negative binomial model is specially useful for discrete data over an unbounded positive range whose sample variance exceeds the sample mean. In fact, in a Poisson model, mean and variance are supposed to be equal. When observations are over-dispersed with respect to the Poisson model, the negative binomial model, having one parameter more than the Poisson model, can be used to adjust the variance independently of the mean. We considered both the over-dispersion at a record level and the spatial correlation at regional level, declaring the regions as "clusters" and introducing geographical partitioning into the model (North-west, North-East, Centre, South and the Islands).

We used the rates ratio (RR) as a measure of effect. Robust standard errors were estimated using the Huber-White method [20, 21].

The third step was to calculate the expected cases of hospitalisation for acute conditions and chronic conditions respectively, on the basis of the probabilities estimated by regression models. The ratios between expected cases and population represented the rates of hospitalisation indirectly standardised for the variables introduced in the regression models, namely age, propensity to hospitalization and prevalence of conditions. We then analyzed the relationship between standardised rates of hospitalization by gender and quantitative measures of primary care services, specifically the number of GPs per 1,000 persons and the number of ambulatory specialist services per 1,000 persons, using non-parametric correlation indexes.

Study approval

The Agency for Public Health of Lazio Region and the National Institute of Statistics are governmental institutions responsible for the health information system; the management of hospital admission data in anonymous format for public health purpose does not require a patient's informed consent nor it does require any authorization regarding privacy laws.

Results

In Italy, in 2005, the hospital admissions for ACSCs among adults were 478,807 (49.9% among males), accounting for 6.6% of total admissions. The admissions for acute ACSCs were 170,883 (35.7%), those for chronic ACSCs were 307,924 (64.3%) (Table 2).

The most frequent conditions were heart failure (39.5%), pneumonia (20.4%), diabetes (12.1%), angina pectoris (7.2%) and urinary tract infections (7.0%). We found that pneumonia and diabetes showed a territorial pattern along the north-south axis. In the regions of the north, hospitalization for pneumonia showed higher percentages than in the southern regions whilst hospitalization due to diabetes showed lower percentages in the north compared to the south. In general, among hospitalizations for ACSCs, the regions of the north showed higher percentages of acute conditions and lower percentages of chronic conditions compared to the southern regions (Table 3).

Specific hospitalization rates for acute ACSC by age group, sex and region were described in Table 4 part A.

Hospitalization rates for acute ACSCs varied widely across the 21 regions and autonomous provinces. Rates ranged from 2.2 in Campania (South) to 6.1 in the province of Bolzano (North East). Males showed higher rates compared to females in all age groups except for the group aged 17-44. Among males, we observed an increasing trend in rates by age group; in females, similar rates were observed in the 17-44 and 45-64 age groups, with slightly higher values for the former group, specifically in the regions of the North. Both males and females showed that hospitalization rates for acute ACSCs in the age group ≥75 years were higher in the northern regions than in southern regions.

Hospitalization rates for chronic ACSCs by age group, sex and region were described in part B of Table 4. The hospitalization rates varied among regions from 4.2 in Piedmont (North West) to 9.8 in Molise (Centre). Rates were consistently higher in males than in females. ACSCs-HR were positively correlated with age for both males and females. A territorial pattern with higher rates in the south of Italy, specially among females, was observed in the age groups 45-64 and 65-74.

By analysing the relationship between ACSCs HRs and selected risk factors through the negative binomial models, we observed a strong and statistically significant interaction between age and sex in all the models. To facilitate the interpretation of the effect measure, age and sex were presented as a single stratified variable with 8 categories: Male <45, M 45-64, M 65-74, M ≥75, Female <45, F 45-64, F 65-74, F ≥75.

Using the Piedmont region as a reference we observed significantly higher rates of hospitalization for acute ACSCs, stratified by age, sex and adjusted for propensity to hospitalization, in two north-eastern regions (Bolzano: Rates Ratio (RR) 1.60; Friuli Venezia Giulia: RR=1.21) and in Sardinia (RR=1.22). Significantly lower risks were observed in Southern regions (Campania: RR=0.71; Calabria: RR=0.86 Sicily: RR=0.84). When analysing chronic conditions, significantly higher RRs were observed in all the regions except Valle D'Aosta and Abruzzo. In the southern regions, RRs were generally higher than in Central and Northern regions of Italy. The observed range of significant RRs for chronic conditions ranged from 1.29 in Emilia Romagna to 1.90 in Sicily. The hospitalization risk for ACSCs tended to be higher among the elderly and among males (except for women aged 17-44 who presented a higher risk of hospitalization for acute conditions compared to males). The influence of the propensity to hospitalization was evident, and its impact was remarkable even after adjusting for age and sex. (Table 5)

When analysing the acute condition of pneumonia, an excess of risk of hospitalization (crude RR=1.26) was observed in the north-eastern regions and a reduced risk in the southern regions (crude RR=0.70) when compared to North-western regions. Adjusted rate ratios differed substantially from the crude ratios showing an excess of risk of about 20% in all the geographical areas, although in central and southern regions they did not reach any statistical

Table 2. Hospital admissions by ACSCs and sex. Italy 2005.

	Total admissions	*ACSCs*		*acute ACSCs*		*chronic ACSCs*	
	N	*n*	*%*	*n*	*%*	*n*	*%*
Males	3,320,000	239,040	7.2	86,875	36.3	152,165	63.7
Females	3,930,623	239,768	6.1	84,008	35.0	155,759	65.0
Total	7,254,667	478,808	6.6	170,883	35.7	307,924	64.3

Table 3. Percentage distributions of ACSCs admissions by type of ACSC and Region. Year 2005.

Region	A1	A2	A3	A4	A5	A6	A7	% A	B1	B2	B3	B4	B5	B6	% B	N
PIEMONTE	0.5	3.2	26.7	4.6	1.5	6.2	2.0	44.6	7.4	1.4	1.1	6.4	37.7	1.3	55.4	28,019
VALLE D'AOSTA	2.2	0.6	21.3	6.5	2.5	7.0	0.4	40.5	2.0	2.3	1.1	10.2	42.4	1.4	59.5	787
LOMBARDIA	0.3	1.6	22.9	3.6	1.3	5.9	1.7	37.3	11.6	2.0	1.0	8.4	37.5	2.2	62.7	74,511
BOLZANO	0.3	2.5	27.7	3.9	2.4	10.6	2.0	49.4	11.8	1.4	2.2	3.9	28.9	2.4	50.6	4,714
TRENTO	0.3	1.1	21.8	3.6	1.1	5.3	1.1	34.2	10.8	0.9	2.2	11.2	39.4	1.3	65.8	4,182
VENETO	0.3	1.9	25.9	3.6	1.0	6.2	1.4	40.2	12.4	1.7	1.1	4.4	38.2	2.0	59.8	40,764
FRIULI-VENEZIA GIULIA	0.3	4.0	25.1	3.4	0.6	6.8	1.2	41.4	6.5	1.4	0.9	4.5	44.0	1.3	58.6	13,276
LIGURIA	0.3	2.3	20.4	3.0	1.7	5.6	1.8	35.2	8.2	1.4	1.2	5.7	46.6	1.7	64.8	14,715
EMILIA-ROMAGNA	0.5	1.9	21.4	4.1	1.3	7.4	2.1	38.5	8.6	1.2	1.2	7.3	41.8	1.4	61.5	40,784
TOSCANA	0.3	2.5	20.8	3.6	1.5	6.0	1.2	35.9	6.3	0.9	1.0	7.0	47.3	1.7	64.1	32,992
UMBRIA	0.1	2.4	21.8	3.8	0.7	7.2	2.2	38.2	8.0	2.1	2.1	7.1	40.0	2.4	61.8	7,234
MARCHE	0.4	3.0	23.3	2.9	0.9	6.0	1.3	37.8	5.3	1.0	1.3	8.0	45.4	1.1	62.2	15,373
LAZIO	0.3	1.5	20.1	3.2	1.0	6.6	1.5	34.2	13.1	1.2	2.7	8.2	38.7	2.0	65.8	41,017
ABRUZZO	0.3	1.0	20.6	2.6	0.7	9.0	1.5	35.7	12.1	1.2	1.9	8.0	38.5	2.7	64.3	12,059
MOLISE	0.3	1.1	18.2	3.2	0.5	8.7	0.6	32.7	10.1	1.4	2.4	4.7	46.4	2.3	67.3	3,895
CAMPANIA	0.2	0.7	14.3	3.5	1.2	6.6	2.3	28.9	13.9	1.6	3.9	8.3	40.1	3.3	71.1	35,044
PUGLIA	0.3	2.1	15.6	3.1	0.9	10.0	1.4	33.3	16.9	1.3	3.9	8.5	33.9	2.4	66.7	33,181
BASILICATA	0.3	1.6	16.3	3.9	0.7	7.1	0.8	30.6	14.8	0.5	3.0	8.5	41.3	1.4	69.4	4,996
CALABRIA	0.2	1.0	11.8	3.3	0.7	7.8	1.3	26.1	15.3	1.3	4.8	8.4	41.8	2.3	73.9	17,136
SICILIA	0.2	1.1	12.8	2.5	1.0	7.7	1.3	26.6	22.8	1.7	3.5	6.4	37.5	1.6	73.4	40,663
SARDEGNA	0.2	2.3	24.2	2.7	0.9	10.3	2.0	42.6	12.4	1.0	2.5	6.3	31.4	4.0	57.4	13,466
ITALY	0.3	1.8	20.4	3.4	1.1	7.0	1.6	35.7	12.1	1.4	2.1	7.2	39.5	2.0	64.3	478,808

A-Acute diseases; A1-Nutritional deficiency; A2-Disorders of hydro-electrolyte metabolism; A3-Pneumonia A4-Bleeding of perforating ulcer; A5-Appendicitis with complications; A6-Urinary tract infections ; A7-Pelvic inflammatory disease; B-Chronic diseases; B1-Diabetes ; B2-Amputation of lower limbs in patients with diabetes;B3-ACSCs ; **B4-Angina pectoris; B5-Hearth failure; B6-Asthma**

significance. Mortality for pneumonia, used as a proxy for the prevalence of the condition, was found to be a strong confounding factor and indeed lower hospitalization rates observed in the South may be due to lower disease prevalence (Table 6). As far as diabetes is concerned, we found an excess of hospitalization crude risk in north-eastern regions (RR=1.22) and southern + island regions (RR = 1.75) compared to north-western regions. By adjusting for sex, age, propensity to hospitalization and prevalence of the condition in the population, we found similar results, although only the estimated hospitalization relative risk in the "Southern regions + the islands" was still significant (RR=1.46, p=0.02) (Table 6).

Finally, when analysing the correlation between the ACSCs-HR and potential risk factors, we found a significant negative association between the provision of ambulatory specialist services and standardised hospitalization rates for chronic ACSCs in general (r=-0.50; p=0.02) and specifically for diabetes (r= - 0.50; p=0.02). We also found an inverse correlation among SHR for acute ACSCs and the rate of GPs per 1,000 residents, (r =-0.39; p=0.11) although not statistically significant.

Table 4. Age specific and standardized (SR) admission rates per 1,000 persons by group of ACSCs, gender and Region.

Part A - Acute conditions														
	Males						*Females*							
Region	17-44	45-64	65-74	≥75	All Males	SR Males	17-44	45-64	65-74	≥75	All Females	SR Females	Males + Fermals	SR - M+F
PIEMONTE	0.9	2.2	6.2	18.7	***3.7***	3.5	1.6	1.3	3.3	10.7	***3.1***	3.0	***3.4***	3.2
VALLE D'AOSTA	1.0	1.9	4.8	16.8	***3.0***	3.1	1.9	1.6	2.8	10.5	***3.1***	3.1	***3.1***	3.0
LOMBARDIA	1.0	2.3	7.4	21.8	***3.7***	4.0	1.8	1.6	3.7	12.7	***3.4***	3.4	***3.5***	3.6
BOLZANO	1.4	3.6	13.4	45.0	***6.3***	7.3	3.1	2.5	7.2	24.3	***5.9***	6.3	***6.1***	6.7
TRENTO	1.1	2.1	7.0	22.1	***3.7***	3.9	1.5	1.4	4.1	12.4	***3.3***	3.2	***3.5***	3.5
VENETO	0.9	2.3	7.4	28.7	***4.2***	4.5	1.6	1.4	3.8	18.5	***4.1***	4.1	***4.2***	4.2
FRIULI-VENEZIA GIULIA	1.0	2.6	8.8	33.3	***5.4***	5.1	1.5	1.5	4.0	22.4	***5.3***	4.5	***5.3***	4.7
LIGURIA	1.1	1.8	5.4	16.5	***3.7***	3.1	2.2	1.5	3.0	11.0	***3.7***	3.2	***3.7***	3.2
EMILIA-ROMAGNA	1.1	2.2	7.2	23.7	***4.5***	4.0	2.0	1.6	3.8	15.7	***4.3***	3.9	***4.4***	4.0
TOSCANA	1.0	2.1	6.8	21.6	***4.2***	3.7	1.5	1.4	3.4	12.3	***3.5***	3.1	***3.8***	3.4
UMBRIA	1.1	2.2	7.2	19.0	***4.2***	3.6	1.8	1.5	3.8	10.5	***3.4***	3.1	***3.8***	3.4
MARCHE	1.0	2.6	7.9	25.9	***5.0***	4.4	1.6	1.7	4.0	15.3	***4.1***	3.7	***4.5***	4.1
LAZIO	1.1	2.3	7.2	17.4	***3.5***	3.6	1.6	1.5	3.6	10.5	***2.9***	3.0	***3.2***	3.3
ABRUZZO	1.3	2.8	8.6	17.3	***4.2***	4.0	2.1	2.1	4.4	10.9	***3.7***	3.6	***4.0***	3.8
MOLISE	1.2	3.7	11.1	24.0	***5.6***	5.1	2.0	2.2	5.2	11.9	***4.0***	3.8	***4.8***	4.4
CAMPANIA	0.9	2.0	5.9	11.2	***2.4***	2.8	1.4	1.4	3.3	5.6	***2.0***	2.2	***2.2***	2.5
PUGLIA	1.1	2.5	7.6	17.1	***3.5***	3.7	1.8	2.0	4.5	11.5	***3.3***	3.5	***3.4***	3.6
BASILICATA	1.2	2.4	6.3	17.9	***3.7***	3.6	1.2	1.5	3.7	8.7	***2.6***	2.7	***3.1***	3.2
CALABRIA	1.1	2.4	6.1	11.2	***2.9***	3.0	1.6	1.9	3.6	6.9	***2.6***	2.7	***2.8***	2.8
SICILIA	1.1	2.2	5.8	12.9	***3.0***	3.0	1.5	1.5	3.5	7.5	***2.5***	2.6	***2.7***	2.8
SARDEGNA	1.4	3.0	8.6	22.1	***4.2***	4.5	2.6	2.1	5.0	14.3	***4.0***	4.4	***4.1***	4.4
ITALY	1.0	2.3	7.0	19.8	***3.7***	3.7	1.7	1.6	3.7	12.2	***3.3***	3.3	***3.5***	3.5

Discussion

Primary care plays a different role in the prevention of hospitalization for chronic and acute conditions. The capacity for early treatment of acute conditions and follow up for chronic conditions may have different and sometimes opposite geographical patterns.

Therefore, when analyzing the relationship

Table 4. Age specific and standardized (SR) admission rates per 1,000 persons by group of ACSCs, gender and Region.

Table 4. Part B – Chronic conditions

	Males						Females						
Region	17-44	45-64	65-74	≥75	All Males	SR Males	17-44	45-64	65-74	≥75	All Females	SR Females	Males + Fermals	SR - M+F
PIEMONTE	0.3	2.9	9.6	23.1	***4.5***	4.2	0.3	1.5	5.3	17.5	***3.9***	3.6	***4.2***	3.9
VALLE D'AOSTA	0.3	3.4	13.0	27.0	***5.0***	5.1	0.1	1.3	6.2	20.0	***4.1***	3.9	***4.5***	4.5
LOMBARDIA	0.7	4.7	15.5	34.6	***6.2***	6.7	0.5	2.3	8.7	27.1	***5.6***	5.7	***5.9***	6.1
BOLZANO	0.6	4.1	16.7	41.8	***6.2***	7.2	0.5	2.8	9.2	35.7	***6.4***	7.0	***6.3***	7.1
TRENTO	0.7	4.4	15.8	45.0	***7.0***	7.4	0.4	2.6	9.5	31.3	***6.5***	6.3	***6.8***	6.8
VENETO	0.6	4.2	15.2	40.1	***6.4***	6.8	0.4	2.0	7.9	31.1	***6.0***	5.9	***6.2***	6.3
FRIULI-VENEZIA GIULIA	0.4	3.8	15.7	43.3	***7.3***	6.9	0.3	1.8	7.8	36.5	***7.7***	6.4	***7.5***	6.6
LIGURIA	0.6	3.6	13.0	32.5	***7.1***	5.6	0.5	1.8	6.5	26.9	***6.7***	5.1	***6.9***	5.3
EMILIA-ROMAGNA	0.6	4.1	13.7	37.6	***7.1***	6.3	0.4	2.0	8.4	31.7	***7.0***	6.0	***7.0***	6.2
TOSCANA	0.5	3.8	13.2	36.1	***6.9***	6.0	0.5	2.0	7.9	30.3	***6.8***	5.8	***6.9***	5.9
UMBRIA	0.7	3.7	14.0	31.0	***6.7***	5.7	0.5	1.8	6.9	23.8	***5.6***	4.8	***6.1***	5.3
MARCHE	0.5	4.2	15.7	40.9	***7.8***	6.8	0.4	2.1	9.3	32.3	***7.1***	6.3	***7.5***	6.6
LAZIO	0.7	4.8	15.1	34.2	***6.4***	6.5	0.5	2.9	9.8	29.3	***5.9***	6.3	***6.1***	6.4
ABRUZZO	0.7	5.1	17.9	33.2	***7.4***	6.9	0.4	3.0	11.8	29.0	***6.9***	6.5	***7.1***	6.7
MOLISE	0.8	6.5	22.4	54.6	***10.8***	9.6	0.5	4.2	13.8	36.3	***8.9***	8.2	***9.8***	8.9
CAMPANIA	0.7	5.3	16.6	29.5	***5.6***	6.5	0.6	3.7	12.9	25.0	***5.4***	6.5	***5.5***	6.5
PUGLIA	0.7	5.8	17.8	33.7	***6.7***	7.1	0.6	4.3	14.9	30.6	***6.8***	7.7	***6.8***	7.4
BASILICATA	0.7	5.3	17.3	35.4	***7.3***	7.1	0.4	3.3	15.6	28.6	***6.9***	7.1	***7.1***	7.1
CALABRIA	0.8	6.2	19.5	39.0	***7.8***	8.0	0.6	4.4	17.0	34.3	***7.8***	8.4	***7.8***	8.2
SICILIA	0.8	6.7	20.1	35.2	***7.7***	7.9	0.7	4.6	15.9	29.6	***7.2***	7.8	***7.4***	7.8
SARDEGNA	0.9	4.1	13.9	34.6	***5.8***	6.3	0.8	2.9	10.1	25.9	***5.4***	6.1	***5.6***	6.2
ITALY	0.7	4.7	15.3	34.7	***6.5***	6.5	0.5	2.8	10.0	28.4	***6.2***	6.2	***6.3***	6.3

between the provision of primary care and hospitalization for ACSC in different geographical areas, it is essential to separate acute from chronic conditions in order to avoid the risk of minimizing or obscuring existing geographical patterns.

In Italy, about 480,000 inpatient hospital admissions in 2005 were attributable to ACSCs. Differences in the hospital admissions for ACSCs can be appropriately used to assess the effectiveness/appropriateness of the primary care

Table 5. Crude and adjusted Relative Rates (RR) of hospitalisations for ACSCs by age, sex, propensity to hospitalisation and region.

	Acute conditions			*Chronic conditions*		
Variables	*Crude RR*	*Adjusted RR*	*p - value*	*Crude RR*	*Adjusted RR*	*p - value*
Sex and Age						
Males Age 17-44 (reference)	1.00	1.00		1.00	1.00	
M Age 45-64	2.20	1.67	0.00	7.11	4.21	0.00
M Age 65-74	6.73	3.14	0.00	23.38	8.33	0.00
M Age >=75	19.00	8.71	0.00	52.85	18.43	0.00
Females Aged 17-44	1.62	1.31	0.00	0.76	0.47	0.00
F Age 45-64	1.51	1.24	0.00	4.20	2.75	0.00
F Age 65-74	3.57	2.18	0.00	15.28	6.82	0.00
F Age >=75	11.65	5.13	0.00	43.29	15.07	0.00
Propensity to hospitalization						
low (reference)	1.00	1.00		1.00	1.00	
medium	1.48	1.23	0.00	2.72	1.66	0.00
high	2.60	1.57	0.00	7.85	2.44	0.00
vey high	11.63	2.54	0.00	39.25	3.95	0.00
Region						
PIEMONTE(reference)	1.00	1.00		1.00	1.00	
VALLE D'AOSTA	0.91	0.90	0.25	1.07	0.99	0.90
LOMBARDIA	1.04	0.98	0.75	1.40	1.42	0.00
BOLZANO	1.81	1.60	0.00	1.49	1.35	0.00
TRENTO	1.04	1.01	0.85	1.61	1.64	0.00
VENETO	1.23	1.06	0.51	1.47	1.36	0.00
FRIULI-VENEZIA GIULIA	1.57	1.21	0.06	1.79	1.31	0.01
LIGURIA	1.10	1.00	0.99	1.63	1.35	0.00
EMILIA-ROMAGNA	1.31	1.07	0.36	1.67	1.29	0.01
TOSCANA	1.13	0.97	0.65	1.63	1.39	0.00
UMBRIA	1.11	0.98	0.81	1.45	1.33	0.01
MARCHE	1.34	1.09	0.27	1.77	1.35	0.00
LAZIO	0.94	0.90	0.15	1.46	1.39	0.00
ABRUZZO	1.17	0.96	0.63	1.70	1.17	0.14
MOLISE	1.40	1.09	0.25	2.33	1.63	0.00
CAMPANIA	0.66	0.71	0.00	1.31	1.41	0.00
PUGLIA	1.00	0.97	0.63	1.61	1.58	0.00
BASILICATA	0.93	0.92	0.24	1.69	1.74	0.00
CALABRIA	0.82	0.86	0.06	1.86	1.75	0.00
SICILIA	0.80	0.84	0.01	1.77	1.90	0.00
SARDEGNA	1.22	1.22	0.01	1.33	1.55	0.00

supplied by regional health services.

Primary care services in Italy are available through Health Districts and GPs. Asthma, diabetes and cardiovascular diseases, amongst other conditions, should all be increasingly managed in primary care settings. In similar health systems, there is growing evidence that a proactive, integrated approach to the management of chronic conditions will result in a reduced need for acute admissions [22]. Active management of the patient, including the appropriate prescription of pharmaceutical intervention, which rests primarily in the hands of GPs, is a key element in the pathway that the patient undertakes, as well as diagnostic treatments [23]. The study revealed a certain heterogeneity in the ACSCs-HR among Italian regions. As hospitalization may be affected by many concomitant conditions such as population health needs patterns, regional

Table 6. Crude and adjusted Relative Rates (RR) of hospitalizations for Pneumonia and Diabetes by age, sex, propensity to hospitalisation, mortality or prevalence of the specific condition and geographical partition.

	Pneumonia			*Diabetes*		
Variables	***Crude RR***	***Adjusted RR***	***p - value***	***Crude RR***	***Adjusted RR***	***p - value***
Sex and Age						
Males Age 1 (reference)	1.00	1.00		1.00	1.00	
Age 2	2.35	1.64	0.00	4.28	2.54	0.00
Age 3	8.14	3.34	0.00	8.88	3.24	0.00
Age 4	24.65	9.73	0.00	10.92	3.82	0.00
Females Age 1	0.67	0.46	0.00	0.67	0.44	0.00
Age 2	1.26	0.93	0.23	3.11	1.96	0.00
Age 3	3.74	1.93	0.00	8.47	3.71	0.00
Age 4	13.12	4.68	0.00	11.92	4.38	0.00
Propensity to hospitalization						
low (reference)	1.00	1.00		1.00	1.00	
medium	1.21	1.34	0.00	2.18	1.53	0.00
high	2.63	1.80	0.00	4.55	2.17	0.00
vey high	15.24	3.00	0.00	12.10	3.20	0.00
Mortality for pneumonia or Prevalence of diabete						
low (reference)	1.00	1.00		1.00	1.00	
medium	1.59	1.22	0.08	0.87	1.03	0.87
high	1.77	1.41	0.01	1.22	1.10	0.66
very high	1.85	1.63	0.00	1.57	1.31	0.29
Geopgraphic partitioning						
North-West (reference)	1.00	1.00		1.00	1.00	
North-East	1.26	1.21	0.01	1.22	1.36	0.12
Centre	1.01	1.20	0.06	1.02	0.98	0.90
South & Islands	0.70	1.20	0.09	1.75	1.46	0.02

health policies, the level of utilization of health services, and appropriateness and equity in the utilization of services, the analysis of ACSCs may be applied as an instrument to monitor and appraise the effectiveness and/or appropriateness of primary care supplied within the different regions through the analysis of hospital discharge administrative data. Because devolution of power has shifted healthcare competencies away from the central Government towards the 21 regions and autonomous provinces, this is of outstanding interest considering the need to assess the impact that devolution may have had on the quality of care and, on the other hand, highlights the scarcity of reliable, feasible and valid data from primary care informative systems in Italy [24]. In our study, hospitalization for acute ACSCs showed different regional patterns for the elderly and for women in reproductive age, both showing higher values in the regions of the North. On the other hand, hospitalization for chronic conditions showed different regional patterns for middle age classes, with lower rates in the regions of the north and higher rates in the regions of the south, particularly for women. Patients with chronic conditions are presumed to have been taken into care previously by primary health care services and in the case of hospitalization, a deficiency of primary health care services can be presumed. The impact of the organization of the regional health system, with the choice of having a higher availability of personnel and equipment at hospital level and a lower one at territorial level, is probably the main reason why the provinces of Trento and Bolzano showed the highest rates for ACSC [25].

In the analysis of hospitalization for pneumonia

and diabetes, we adjusted RRs according to the prevalence of the specific condition, using mortality as proxy for the prevalence of pneumonia. The prevalence of a condition is considered as one of the main factors associated with hospitalisation [11]. In our study we showed how hospitalization rates were higher in regions with a higher prevalence of diabetes and pneumonia.

Primary care supply measures, expressed through the number of patients per GP and the number of specialist care services, were related to hospitalization for ACSCs: the number of GPs with acute ACSCs, and ambulatory care services with chronic conditions. These indicators of health care services supply are not independent. In fact, it was found that more than 80% of the specialist services were prescribed by GPs [26]. Nevertheless they showed an opposite regional pattern with Northern regions having more specialist services and less GPs, conversely to Southern regions, suggesting a different attitude of the GPs towards specialist interventions.

Limitations of the study rest on the fact that administrative data were used for epidemiologic purposes and hospitalization was analysed only in contracted facilities, even though they accounted for 96% of admissions. Some factors, such as the prevalence of specific conditions and the propensity to hospitalization were measured at a regional level. Thus, a possible ecologic fallacy may affect results. Moreover, data on the prevalence of specific conditions were not available for all pathologies studied, limiting the analysis of these important risk factors to only two conditions: diabetes and pneumonia. The presence of co-morbidity in patients with ACSCs may also play a role in the risk of hospitalization and should be considered in future analyses. Unfortunately the authors could not access this information. Moreover, we were able to use indicators of primary care to provide an estimate of the extent of primary healthcare service provision, but not to evaluate their quality. Information regarding the organization and functions of primary care services, which may greatly differ among regions, should also be considered. The strength of the study lies in the fact that we were able to analyse the risk of avoidable hospitalizations by using individual information, adjusted for demographic risk factors whilst simultaneously considering contextual factors, measured at a regional level, such as the propensity to hospitalization and the prevalence of specific conditions.

The notion of avoidable admissions, however, rests on the assumption that the provision of good primary care alone can dramatically reduce hospital admission rates. There are a number of other reasons, however, why chronic disease may be harder to manage in certain areas. The prevalence of chronic conditions may vary widely within the population, and the supply of primary care may also vary among the regions. We considered both factors in specific regression models used to analyse the hospitalization for diabetes and pneumonia. When analysing the regional ACSCs-HR adjusted for the propensity to hospitalization, sex and age distributions, the regional crude risks of hospitalization did not differ too much from the adjusted ones. This should mean that variability for those factors do not explain the large variation of hospitalization among regions. Conversely, in the analysis of specific conditions (pneumonia and diabetes) the prevalence of the condition had a great impact on HRs, insofar as the pattern of adjusted HRs in Italian regions differed substantially from crude ones.

Our study showed the dimension of the issue at national level through analysing what factors play a major role in the risk of hospitalization for ACSCs. Current national and regional health plans aim to drastically reduce the number of hospital beds, and to improve the quality of primary and secondary care. Hospital beds should be reduced by 11,000 in 2011 according to the National Health Plan 2010-2012. The hospital setting should become the health care setting exclusively devoted to acute disease and emergency care, leaving the task of coping with chronic diseases and prevention to primary care. This model, experimented in other European countries, may encounter many problems in Italy. The choice of hospitalization is often induced by the scarcity of outpatient healthcare services (OHCS), that have no incentive for avoiding hospitalization. When a patient has a complex health problem, hospitalization seems to be the best choice, regardless of appropriateness [27].

The incidence of chronic diseases, like diabetes, is likely to increase steadily in the future, mainly because of the ageing population [28]. The health care system may not be able to afford the costs related to the assistance for such chronic diseases, if it relies mainly on hospital settings. Policies aiming at assisting persons with chronic care as outpatients are therefore essential, but incentives and widespread presence of OHCS are needed as well as a cohesive collaborative system able to integrate the different health care levels [29].

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