



## Individual and hospital-related determinants of potentially inappropriate admissions emerging from administrative records

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### ABSTRACT

**Introduction:** The appropriate use of health care is an important issue in developed countries. The purpose of this study was to ascertain the extent of potentially inappropriate hospital admissions and their individual, clinical and hospital-related determinants.

**Methods:** Medical records were analyzed for the year 2014 held by the Local Health Unit n. 13 in the Veneto Region of north-east Italy (19,000 records). The outcomes calculated were: admissions for conditions amenable to day hospital care; brief medical admissions; outlier lengths of stay for elderly patients' medical admissions; and medical admissions to surgical wards. Univariate analyses and logistic regression models were used to test associations with demographic, clinical and hospital ward covariates, including organizational indicators.

**Results:** Inappropriate reliance on acute care beds ranged from 6% to 28%, depending on the type of quality indicator analyzed. Some individual features, and wards' specific characteristics were associated with at least one of the phenomena of inappropriate hospital resource usage. In particular, male gender, younger age and transfersals seemed to affect inappropriate admissions to surgical wards. Potentially avoidable admissions featuring inpatients amenable to day hospital care were associated with subjects with fewer comorbidities and lower case-mix wards, while inappropriately short medical stays were influenced by patients' higher functional status and local residency and by lower bed occupancy rates. In conclusion, inappropriately long hospital stays for elderly cases were associated with patients with multiple pathologies in wards with a low bed-occupancy. Education level and citizenship did not seem to influence inappropriate admissions.

**Conclusions:** Some individual, clinical and structural characteristics of patients and wards emerging from administrative records could be associated with inappropriate reliance on acute hospital beds. Analyzing the indicators considered in this study could generate inexpensive real-time data for identifying what determines potentially inappropriate hospital resource usage, and thus orient auditing activities and health care policy-making.

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## 1. Introduction

One of the most relevant public health system quality assurance issues is the appropriateness of health care facility usage because this influences the proper allocation of limited resources. The burden of chronic diseases in aging populations, the massive use of advanced technologies, and patients' growing expectations are overloading health care systems and giving rise to an unsustainable provision of care of limited added value [1–3]. An effort is consequently needed to reduce the waste of health care resources. Many studies in the past have discussed the problem of unnecessary or preventable hospital admissions, or inappropriately long hospital stays [4–6]. Inappropriate hospital admissions in situations where beds and staff are in short supply have a negative fallout on patient safety and health outcomes [7,8].

The most common, standardized method for assessing the appropriateness of hospital admissions is the "Appropriateness Evaluation Protocol" (AEP) [9,10], a multidimensional, structured assessment tool that analyzes each day of a hospital stay. The AEP has several drawbacks, however: it is time-consuming; the results are biased by inter-operator variability; and it cannot be applied to administrative datasets, but only to single clinical cases. To overcome these issues, a panel of ICD codes considered suitable for outpatient treatment called Ambulatory Care Sensitive Conditions (ACSC) [11] was introduced in the 1990s. Hospitalization for these codes has been targeted as an indication of insufficiently accessible and poor-quality primary care services [12,13], and it often involves an avoidable burden on emergency departments [14]. Given the increasing availability of up-to-date public health administrative and clinical data, the adoption of novel indicators of the appropriateness of hospital admissions and stays should be encouraged to avoid the unnecessary costs of complex analyses and assessment strategies. In Italy, admissions amenable to day hospital care, brief medical admissions, outlier lengths of stay (LoS) for elderly patients' medical admissions, and medical admissions to surgical wards are systematically identified in official reports on hospital usage trends [15,16] for the purpose of monitoring the organizational appropriateness of hospital admissions emerging from administrative data. These indicators are recorded systematically and benchmarked at regional and local level, so new insight can be gained on the patient- or hospital-related determinants of these outcomes. Some studies in the past showed that age, gender, education or clinical condition could influence inappropriate hospital usage [17–24], but none of them considered large-scale datasets or hospital efficiency markers. Taking this novel approach can provide organizations (hospitals, local health units, etc.) with easily-interpretable, real-time references for identifying conditions at risk of inappropriate resource use and thus enable prompt, targeted corrective action. Hence this paper on the inappropriate use of hospital resources emerging from the administrative records, which aimed to see which demographic and clinical features of patients, and which characteristics of hospitals and wards are associated with this phenomenon.

## 2. Methods

### 2.1. Context

The Italian NHS (National Health System) was established in 1978 and modeled along the lines of the British NHS. It is a mainly public system financed by general taxation. Health system is based on the fundamental values such as universality, free access, freedom of choice, pluralism in provision and equity. Regional authorities plan and organize health care facilities and activities through their regional health departments in accordance with a national health plan designed to assure an equitable provision of comprehensive care throughout the country. The regional authorities coordinate and control local health units (LHU), each of which is a separate National Health System (NHS) unit that plans and delivers health care services to its local community, based on a regional health plan. The Veneto Regional Health Service, where this study was conducted, is a complex mix of 21 public LHUs, serving a population of about 5 million inhabitants. In 2012, there were 3.32 beds (public and private accredited) per 1000 inhabitants. The hospital network includes 8 major "hubs" with regional or provincial catchment areas and 19 local "spokes" serving 200,000 residents each. There are also 40 smaller hospitals serving as additional nodes in the network or providing specific services (e.g. mental health or rehabilitation clinics). The LHU involved in this study was the "Azienda ULSS 13-Veneto", which serves a population of about 250,000 in the province of Venice, north-eastern Italy. The area is served by only one hospital with 600 beds divided between two different sites, which handles about 19,000 admissions a year. The two sites are interconnected, they are located few kilometers away from each other and are intended to function as a single hospital: they in fact share the same management, have a similar number of beds, provide the same health care services and are typical of the "spoke" hospitals in the regional (and Italian) network. They manage multidisciplinary acute and scheduled inpatient and day-hospital admissions, and they both have an emergency department, an intensive care unit, and traditional clinical services. Third-level specialized care is provided by two large hubs located outside the LHU. There is also a rehabilitation facility for providing scheduled long-term care for patients discharged from hospital, which was excluded from the present study.

### 2.2. Materials

We analyzed all available records on inpatients aged 18 years or more in the administrative database of the LHU n. 13 (LHU13) for the year 2014. We considered the electronic hospital discharge records (SDO, in Italian "scheda di dimissione ospedaliera" [25]), which contain patients' personal details and information on their hospital stays. Health care providers are periodically assessed by the regional healthcare auditing service, which checks the consistency between patients' clinical records and their discharge forms.

The database includes:

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