The relationship between avoidable hospitalisation and primary care

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The relationship between avoidable hospitalisation and primary care

Aldo Rosano

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The relationship between avoidable hospitalisation and primary care

DISSERTATION

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as fundamental right
of the individual and as collective interest*

*De Republiek waarborgt gezondheid
als een fundamenteel recht
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Art. 32 Italian Constitution

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Chapter 1

Introduction

The relationship between avoidable hospitalisation and primary care

Conceptualisation, analysis and relevance in the Italian context

Aims of the thesis

Avoidable Hospitalisation (AH) is a concept widely adopted to assess accessibility and quality of primary care (PC). This topic has been extensively analysed in the United States of America (USA), while in European countries it has been dealt with only recently. The evaluation of PC is a key element in the assessment of the healthcare system (HCS), and in Italy a comprehensive study on the use of AH for this aim has not yet been done.

The general aim of this study is to analyse the role of PC in preventing hospital admissions for some types of conditions and the factors influencing the relationship between AH and PC.

Specific aims of the study are: i) to investigate AH as a tool to assess the quality and accessibility of primary care through a systematic review of relevant literature; ii) to examine the variability of AH rates in time and space in the Italian regions and to verify to which extent the trend of the AH rates is attributable to changes in PC; iii) to analyse the factors influencing the variability of AH and their relationship with primary care services in Italy; iv) to analyse the relationship between AH and PC comparing countries with different HCSs; v) to investigate the association between specific GP activities and the rates of AH in their patient population.

Background: from Avoidable Hospitalisation (AH) to Hospitalisation for Ambulatory Care Sensitive Conditions (ACSC)

Conditions treatable by medical interventions available in primary care or by patient monitoring, patient education and the appropriate use of pharmaceuticals are considered 'Ambulatory Care Sensitive Conditions' (ACSC). These are conditions that only need inpatient care in exceptional circumstances (e.g. terminal stage) as hospitalisation can be prevented by appropriate outpatient care either by primary care or by outpatient specialist care. The present study is limited to primary care, because in many HCSs, especially of the type of the United Kingdom's National Health Service (NHS), primary care has an explicit function to contain the use of specialist medical care by acting as 'gatekeepers' for hospitals and specialists (Dixon, 1998). In countries where general practitioners (GPs) are 'gatekeepers', such as the UK and Spain, there is a clear increase in services shifted towards primary care from specialist care as well as from hospital settings (Masseria, 2009).

Before going into depth with issues treated in this thesis, it is worthwhile to specify some key concepts: Primary Care, Avoidable Hospitalisation, Quality and Accessibility of Primary Care.

Primary care is the entry level of a HCS providing accessible, comprehensive care in an ambulatory setting to patients in their own context on a continuous basis, and coordinates the care processes of patients across the HCS (Starfield, 1994).

Hospitalisation can be defined as avoidable when treatment can be provided before health problems become so severe that hospitalisation becomes necessary. In the scientific literature the term avoidable hospitalisation (AH) is often replaced by

hospitalisation for Ambulatory Care Sensitive Conditions (ACSC) (Ansari, 2002; Caminal, 2004; Pirani, 2006; Freund, 2013). Hospitalisation for ACSC (ACSH) has been widely adopted as an outcome measure in the assessment of accessibility and overall effectiveness of PC. (Jorm, 2012; Yongyuth, 2011).

Quality of primary care includes the dimensions of access, continuity, coordination and comprehensiveness of PC health services. AH is considered as an outcome measure in studies that focus on the consequences of variations in the quantity and quality of PC (Schäfer, 2013). In general, access to health services can be defined as the ease with which healthcare is obtained (Kelley & Hurst, 2006). There are various barriers of physical, psychological, socio-cultural and financial nature that can restrict accessibility. Examples of such include: geographical limitations, factors related to the organisation of primary care practice, as well as the costs incurred by patients. Primary care ideally provides accessible care to all patients, regardless of the type of health condition and personal characteristics (European Observatory on Health Care Systems and Policies, 2006). When primary care is organised in a way that facilitates access whenever a patient is in need of healthcare (Ferrer ,2005) treatment can then be administered before health problems become more severe (Green ,2004). The propensity to seek care is also relevant; individuals who seek care later in the course of chronic disease flare-ups (for example, patients who seek care after urinary tract infections have affected the kidneys) are more likely to require hospitalisation (Institute of Medicine, 1993).

It should also be considered that it is improbable that any subject suffering from ACSC can always avoid hospitalisation. There is in fact a structural gap between PC and acute care, e.g. a patient with pneumonia who needs to be monitored only has the option of being hospitalised (Miller, 2003). A policy problem is to establish what rate of AH is 'unacceptable' and therefore constitutes a problem. Comparative studies may help to define a sort of threshold: areas with the lowest rate of AH can be considered as benchmark, even though further decreases in AH could also be obtained in areas with the lowest rates, once reasons for underconsumption of hospital care are excluded.

Evidence about the role of PC in improving health outcomes has led to a rapid increase in interest in assessing PC achievements. Despite its importance, there are few indicators to assess the extent to which people receive adequate PC. As a result, there are efforts to develop instruments that directly assess the adequacy of PC. Direct measures of PC accessibility are, e.g. the number of GPs per 1,000 residents and the number of general practice consultations per capita. Direct measures of PC efficiency include the average consultation lengths of GPs, and the number of new referrals from GPs to medical specialists per 1,000 listed patients or contacts. Measures of PC quality include the percentage of infants vaccinated against hepatitis B and the percentage of elderly vaccinated against influenza (Kringos ,2010). However, such indicators only capture partial aspects of accessibility and quality of PC and data necessary for their calculation are not often available. Conversely, overviews of AH can be easily generated from routine hospital data, focusing attention on the outcomes of care, rather than processes or procedures (Jorm, 2012).

AH may be also used to compare health system performance, to evaluate healthcare policies, and as a part of PC auditing (Brown, 2001). Many authors have evaluated the relationship between AH and income levels, insurance status, race and ethnicity (Weissman et al.,1992), often finding a correlation between hospitalisation for ACSC

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and lower socio-economic status and/or compromised access to care (Saxena,2006; Yuen, 2004).

Evolution of the concept and measures of AH

In the USA, the use of AH as an outcome measure of accessibility and quality of PC dates back to the second half of the 1970s, while in European countries the first studies appeared in the mid-1990s and only in the UK, Italy and Spain. The origins of contemporary ACSC hospitalisation measures are found in the pioneering work of Rustein (1976) who identified a set of medical conditions called “sentinel health conditions or events”. In 1990, single conditions were categorised into so-called ACSC by Billings (1993) and an advisory panel of experts on primary care. In 1992, Weissman (1992) extended the “sentinel health conditions” approach evaluating the correlation between insurance status and rates of avoidable hospitalisation, by building up a set of 12 ACSC, using the following selection criteria: consensus, importance (as health problem), clinical face validity, data clarity. This represents the key study on the issue. The list of ACSC has been amended several times, but the “core conditions” are always those proposed by Weissman (1992). Since 1993, the Institute of Medicine (IOM; 1993) has recommended hospitalisation for ACSC as an outcome indicator of the accessibility and overall effectiveness of primary healthcare.

The main concerns of investigators in selecting the ACSC were the stability of ACSC hospitalisation rates and the reliability of diagnosis coding (Billings,1993; Sanderson & Dixon, 2000). For these reasons the selected lists included conditions not rare and having specific International Classification of Diseases, ninth revision (ICD9) codes. Bindman (1995) selected the ACSC “as clearest examples of chronic conditions that could benefit from outpatient treatment”. The hospitalisation rates may depend on variation in disease prevalence, healthcare-seeking behaviour, and physician practice style. Therefore Bindman (1995) argued the need to consider such factors when selecting the ACSC to be investigated in a given context.

Sanderson and Dixon (2000) in the UK, reported about a consensus team composed of GPs and specialists who identified 30 conditions amenable to avoiding hospitalisation. The selection of the conditions started from an initial list of 176 conditions considered potentially avoidable, having a sufficient number of expected admissions to provide a stable frequency and good enough reported diagnosis on hospital records. The 30 selected conditions were judged to potentially receive better management by timely and effective ambulatory treatment if at least 70% of relevant admissions could be considered really “avoidable”. Selected conditions were classified according to urgency into “usually urgent” and “usually not urgent”.

Caminal (2004) adapted the list of ACSC and the diagnosis codes proposed by Weissman (1992) to the European context combining consensus criteria with objective criteria. It was considered both the conceptual basis for relating a condition to the activities of PC and what aspect of this level of care would be primarily responsible for reducing hospitalisation rates. This process involved three steps: the gathering of information from the literature, judgements by experts concerning the suitability of each of the codes previously used using a Delphi technique, and the final selection.

Bottle (2006), in the UK context, used the ACSC to identify patients who might benefit from more intensive and carefully monitored treatment in primary and secondary care. Such patients are considered at high risk of emergency room visit, which often

results in hospital admission. Patients suffering from ACSC might represent manageable caseloads for community health services and primary healthcare professionals, thus amenable to preventing an emergency admission.

Although there seemed to be a certain consensus about the definition and operationalisation of ACSC, Purdy (2009) argued such definitions have neither a homogeneous meaning, nor a comprehensive application. In their study Purdy and colleagues identified a list of 36 ACSC, but, depending on the condition, also found a considerable variation of ICD codes used to identify them.

Acute and chronic ACSCs

ACSC are usually grouped into two different lists of conditions according to the different prevention strategies: the first include conditions that are supposed to be prevented through early diagnoses (and treatment) of the condition or its precursor; the latter through good ongoing control and management (Agency for Healthcare Research and Quality, 2004; Caminal, 2004). The first list includes acute conditions such as disorders of hydro-electrolyte metabolism, pneumonia, bleeding of perforating ulcers, appendicitis with complications, urinary tract infections, and pelvic inflammatory disease; the latter includes chronic conditions such as diabetes, amputation of lower limbs in patients with diabetes, hypertension, angina pectoris, heart failure, asthma, and chronic obstructive pulmonary disease. Given the different prevention strategies, chronic and acute conditions are used to be analysed separately in this thesis.

Day surgery and day care are hospital settings that can be considered in the same way as an ambulatory setting in terms of costs and patient comfort. For these reasons, day care admissions cannot be considered avoidable events in the same way as ordinary admissions, which involve higher costs and higher iatrogenic and side effect risks for patients. Therefore in this thesis the concept of AH is focussed on ordinary admissions. In recent years, with the aim to reduce hospitalisation, many countries, including Italy (Zocchetti & Cislighi, 2011), decided to move many diagnostic and surgical procedures from ordinary admission to day surgery and day care.

Outpatient care or primary care?

In outpatient care, Primary Care (PC) plays an important role. Evidence of the relationship between rates for ACSH and indicators of PC (number of GPs and visits per 1,000 persons) has been found in the UK (Saxena, 2006) and in Italy (Cacciani, 2008). GPs have a key role in the mechanisms regulating care provision in many countries: their formal and informal links with other sectors of the health system, in particular hospital settings and specialists, have to be analysed in depth.

Intermediate care, which substitutes for elements of acute hospital care (substitutional care), also plays a role in preventing unnecessary hospital admissions and facilitating early discharge. Other services such as outpatient clinics, diagnostic and therapy services, and day care may also be provided. We are talking about services that do not require the resources of a general hospital but are generally beyond the scope of the traditional PC team (Joint Improvement Team, 2007).

Good and timely access to outpatient specialist care (secondary care) might also prevent inpatient admissions (Agency for Healthcare Research and Quality, 2004;

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Agabiti, 2009). In most Organisation for Economic Co-operation and Development (OECD) countries there is a rising concern with regard to increasing healthcare costs. There is also a continuing worry about the range of referral rates which raises the concern of both over- and under-use of secondary care (Raleigh, 2012). Care in the community, such as PC, is cheaper than specialist care, which is often provided within hospitals and can, in some cases, safely be transferred from specialists to PC practitioners with no increase of overall demand (National Primary Care Research and Development Centre, 2006).

Access to secondary care varies considerably among countries: NHS models, such as those in Italy, the United Kingdom and the Scandinavian states, have stronger control over the system, i.e. the demarcation between PC and secondary care is usually clear and GP is an effective 'gatekeeper'. PC facilities are usually the patients' first point of call, although in some NHS systems, like in Sweden, direct access to specialists may also be possible.

In the USA patients can refer themselves to secondary care (Ringberg, 2013). In many countries with private practice and health insurance, PC continues to be physician-centred and oriented towards curative services. Group practices and teamwork are emerging, but most GPs still work alone. They often compete with specialists for patients. Their 'gatekeeper' role is limited if patients can go freely and without additional financial cost directly to a specialist or to a hospital outpatient department. In many countries, such as Germany, Greece, and the Netherlands, market elements are increasingly introduced into the HCS, along with elements of integrated care. Traditionally, the trade-off between equity, efficiency and choice in these countries is bent more toward choice and efficiency and less toward equity (World Health Organization, 2013).

Fleming (1993) in his European study on GP referral rates reported a Norwegian referral rate of 8.2%, the highest rate among the 12 participating countries, in which the Italian referral rate was 6.7% and the British one was 4.7%. Improvements in preventive secondary care do not seem to be correlated with changes in hospitalisation rates (Bardsley, 2013). On the other hand it is undoubted that secondary care and referral modes may play a role in preventing hospitalisation. In fact, Congdon (2006) found in the UK variations in attendance and admission rates across areas and practices, after controlling for need, remaining differences between practices may be attributable to referral behaviour unrelated to need, or to staffing, resourcing, and access issues.

European countries differ both in the PC organisation and in outpatient specialist care provision: in countries like the Netherlands and the UK specialist care is tied to hospitals. In other countries like Germany ambulatory specialist care is provided by independently established specialists, while salaried specialists are tied to hospitals and provide mostly inpatient care. Hence, it is difficult to obtain comparable measures of outpatient specialist care among countries. Finally, the type of HCS and its effectiveness may also heavily influence the relationship between the provision of outpatient care and hospitalisation. These factors hampered to consider outpatient specialist care in this study.

The cost of AH

The proportion of hospital admissions for ACSC has been found to account for 3.2% to 12% of all hospitalisations (Weismann, 1992; Pappas, 1997; Gil, 1997; Bluestein,

1998) with rates varying from 8.9 to 59 per 10,000 persons (Bindman, 1995; Komaromy, 1996) depending on the definitions and number of medical conditions included. The cost of hospitalisation for ACSC was estimated in different contexts: in Canada hospital costs for heart failure were CAD 425 million and for pneumonia CAD 193 million in 2005 (Canadian Institute for Health Information, 2008); in Italy in the same year (2005) hospitalisation for ACSC accounted for about 480,000 admissions (Rosano, 2011), with an approximate cost of EUR 1.4 billion. Casanova and Starfield (1995) concluded in their study that the provision of universal access to healthcare was associated with lower hospitalisation rates (and lower costs) for conditions amenable to adequate PC.

Given the government's strong role in funding and providing primary care services for NHS systems, it is expected that strong PC is more likely to be part of the policy agenda of NHS systems than in countries with social security-based systems or health systems in transition. Evidence shows that population health is better in countries with relatively stronger PC rather than those with relatively weak PC (Starfield, 1998; Kringos, 2013). Socio-economic inequalities in health are reduced, at lower costs, in systems oriented to disease management and specialty care (Starfield, 2011), even though, in more recent years, in those countries health spending seem to be higher (Kringos, 2013).

Healthcare planners can assess the impact of programmes and policies designed to improve healthcare accessibility and develop targeted interventions for reducing both access barriers and the occurrence of avoidable hospitalisation using the evidence from the analysis of hospitalisation for ACSC. The emphasis on primary care in Western Europe is expected to be an answer to questions of rising costs and changing demand in the healthcare sector.

Statement of the problem

ACSCs represent a range of conditions that could be treated in a PC setting (i.e. a physician's office, community health clinic) or in an outpatient specialist care setting, so that hospitalisation may be avoided or postponed as much as possible (Cloutier-Fisher, 2006). Thus, timely and effective primary care may often prevent ACSH. This premise has been supported by clinical research into causes of hospitalisation (Laditka, 2003). Conditions, such as hypertension, diabetes, chronic heart failure, chronic obstructive pulmonary disease and asthma, can be managed with timely and effective outpatient care, thus reducing the need of hospitalisation. Empirical research examining the relationship between ACSH and access to medical care has produced, however, conflicting results (Ansari, 2006), varying from country to country. In the USA, the majority of the studies found an inverse correlation between PC quality and accessibility and AH (that is to say, less AH is correlated with better PC accessibility), but a considerable number of studies found an unexpected positive correlation (Schreiber & Zielinski, 1997; Bluestein, 1998; Basu & Cooper, 2000; Saha, 2007); this was also the case in Brazil, with one study finding a direct correlation (Fernandes, 2009) and one an inverse one (Guanais & Macinko, 2009). In European countries findings are more consistent, with the majority of the studies finding an inverse correlation: no study in Europe found a positive correlation between AH and PC (Rosano, 2013a).

Healthcare provided at acute hospitals is the most expensive part of the health and social care system for a range of chronic conditions, indicating poorly allocated resources that have led to unacceptably long waiting times for elective health

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services. Rising healthcare costs can be contained by reducing the volume of hospitalisations that could be avoided through improved quality of PC. The challenge is to validate the ACSH rates as outcome measure of the performance of the PC delivery system and to identify the factors influencing the relationship between AH and PC performance.

Healthcare in Italy

Italy (in 1978) adopted a so called Beveridge healthcare model,¹ which was reformed in 2001 into a federal HCS, in which 21 regions have competence concurrent with the central state. The Italian healthcare system (IHS) provides hospital accommodation and treatment (including tests, surgery and medication during hospitalisation), visits to family doctors (GPs), specialist medical assistance provided by paediatricians, obstetricians and other specialists, discounted medicines, laboratory services, appliances, ambulance services and free services at a local health unit. Those who are registered with the IHS are entitled to free or subsidised medicines, outpatient and after-care treatments are generally provided with cost sharing, but are free for exempted patients (e.g. the elderly, people with severe chronic conditions, pregnant women). All inpatient treatments, i.e. treatment requiring hospitalisation, are free under the IHS. Many medical expenses can be totally or partially deducted for tax purposes. Outpatients are mainly treated by GPs and specialists in ambulatory settings. Ambulatory healthcare is provided by public sector (hospital and district healthcare units) and private for-profit providers. Health professionals can be chosen by patients through the regional healthcare system, upon referral by a GP. In general it is very simple to request a specialist visit from GPs. Patients have free choice of GP, who acts as 'gatekeeper'. GPs and ambulatory physicians have contracts with the regional health authority regulated by agreement among associations of physicians and regional and national health authorities. Patient satisfaction with GPs is generally high (CENSIS Foundation, 2010). Patients are given the choice of opting for private, contracted-out hospitals that are required to be accredited by the regional government. However, given that the health system is ruled on a regional basis, some aspects may differ from region to region. Italy has been trying to reduce costs in the hospital sector, as well as the number of hospital beds, for many years. This reduction, being one of the more pronounced in the last ten years among OECD countries (from 6.4 per 1,000 persons in 2000 to 3.5 per 1,000 persons in 2010). In the same period the annual increase of health expenditure ranged in Italy from 4.3% in 2001 to -1.6% in 2001 versus 5.5% in 2001 and 0.6% in 2011 as averages of OECD countries (OECD, 2012). It is likely that the hospital beds reduction, which implied a decrease in acute hospital admissions from 157 per 1,000 persons in 2000 to 127.5 per 1,000 persons in 2009, has contributed to the reduction of health expenditures in Italy.

Innovations in PC organisation in Italy

The importance of PC in any HCS is undisputed, and many countries are currently engaged in system reforms that aim to strengthen the PC sector. The need to address increasing healthcare costs and the challenges of long-term illness were the main factors that triggered this need for reform (Van Weel, 2012). In the past couple

¹ In the Beveridge 'public' model, funding is based mainly on taxation and is characterised by a centrally organised NHS where the services are provided by mainly public health providers (hospitals, community doctors, etc.). In this model, healthcare budgets compete with other spending priorities of the government.

of years, reforms of Italy's healthcare system have also had a common theme: budget cuts. In 2012 a primary healthcare reform (Law 189/2012) was approved ordering the reorganisation of healthcare at the regional level, with the introduction of teams of primary healthcare professionals to ensure 24-hour coverage, which was never previously guaranteed in Italy. The idea behind the reform was to improve the cost-effectiveness and sustainability of the health system, while continuing to ensure high quality health care (Paterlini, 2013).

Specialist expertise and managed care pathways are relevant, and there will be an increasing demand for them; they should be integrated into and coordinated by comprehensive PC, to support and empower continuity of care between GPs and patients (De Maeseneer, 2012). In Italy, the creation of 'Health Houses' – a sort of PC trust - with GPs, nurses, social workers, and specialists working together and sharing facilities and diagnostic tools, goes in this direction. The 24-hour coverage, the creation of 'Health Houses', along with a new organisation of PC delivery, called 'PC in association',² are mainly aimed at moving from inpatient care to PC in the general delivery of health care.

In previous Italian studies the temporal trend of hospitalisations for ACSC and the correlation with average income level were analysed (Pirani, 2006; Agabiti, 2009) as well as the relationship between the PC access characteristics and AH (Rizza, 2007) but in a limited geographical context, such as the cities of Bologna and Catanzaro, and not considering relevant factors potentially influencing the relationship between PC and AH, such as the epidemiology of the ACSC or the propensity to seek hospital care.

Research questions

1. What is the relationship between AH and measures of accessibility to PC in the international Health Services Research literature?

Studies examining the relationship between primary health care supply and ACSH found contradictory results: some found the expected inverse correlation; some found a positive correlation; and some found no correlation at all. Some studies found the expected inverse correlation using unadjusted analyses, whereas in analyses adjusted for socio-economic status of the population the final results were exactly the opposite (Ansari, 2007). Studies taking into account the presence of managed care health coverage plans as an indicator of accessibility and quality of PC did find lower rates of hospitalisation for ACSC among covered subjects (Bindman, 2005; Laditka & Laditka, 2001). In general, studies have shown that better outpatient care can reduce patient complications, including those leading to re-admissions for ACSC. In order to clarify these sometimes conflicting results, a systematic literature review was undertaken to identify the key factors influencing the relationship between AH and PC. As results may differ across countries and HCSs according to the role of PC and hospital care, our study group explored the relationships in different HCSs.

2. Does the trend of AH deviate from the general hospitalisation trend in Italy?

² In this so-called 'team practice', the delivery of PC services is provided by a group of GPs who coordinate their activity so that an increased availability of time of care and resources are guaranteed to patients.

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In Italy, hospitalisation rates steadily decreased over the last 20 years. Therefore, there will also be a likely observed decrease in hospitalisation due to ACSC. Risk factors associated with ACSH, such as socioeconomic status of patients and the prevalence of the disease, are not supposed to have changed in recent years. We explored the trend based on rates of hospitalisation of ACSC in Italian regions from 2001 to 2008 trying to verify in which terms it is attributable to the general trend of reduction in hospital use rather than changes in PC health care delivery. In Italy during the study period an innovative form of PC delivery was progressively introduced: PC team practice. It is constituted of a pool of GPs who decide to share structures and facilities and decide to collaborate on common projects. The main benefits that team practice guarantees can be summarised by: continuity of care; availability of GPs for more hours per day and days per week; and adherence to guidelines and innovative projects. However, the trend of ACSH might simply reflect the general trend – steadily decreasing - of hospitalisation, of which it forms a part, rather than improvements in the delivery of PC services.

3. What are the factors influencing the relationship between PC provision and AH and how do they manifest themselves differently across geographic areas in Italy?

In any given geographic area, the expectation is that the rates of AH will be lower when people are receiving the PC they require. Conversely, in areas where access to medical care is more limited, rates of AH tend to be higher (Cloutier-Fisher, 2006). The analysis of indicators of PC and rates of AH by geographic area may help to better understand this relationship. Moreover, it is fundamental to analyse separately acute and chronic conditions as they possibly have distinct geographical patterns and relationship with the explanatory factors.

The notion of avoidable admissions, however, rests on the assumption that the provision of good PC alone can drive down hospital admission rates. There are a number of other reasons, however, explaining why chronic diseases may be harder to manage in certain areas. The prevalence of chronic conditions may vary widely within a population, and the type and the degree to which the hospital care is offered may vary among areas. Thus it is important to revise and analyse factors, other than quality of PC, potentially associated with AH. Factors that have been demonstrated to influence the relationship between AH and PC supply include, e.g. the number of hospital beds, the epidemiology of conditions as well as the socio-economic status of the population.

In Italy the organisation of healthcare as well as the epidemiology of chronic diseases varies among regions. The analysis of the variability among the Italian regions of hospital admissions for ACSC, and their relationship with PC supply can be used to assess the effectiveness and/or appropriateness of the PC supplied within the different regions.

4.What are the differences in the role of primary care between countries with different HCSs: the case of Italy and Germany

Italy and Germany are countries with both similarities and differences in the organisation of their HCSs; for this reason they are suitable for a comparative test about the role of PC. Comparisons among countries with different HCSs may be helpful to better understand the role of PC in relationship with AH in countries adopting different models of PC, and to understand the relevance of ACSH to assess the influence of PC accessibility and quality.

The comparison was conducted through a descriptive analysis of hospitalisation rates for ACSC occurring from 2000 to 2008 and a correlation analysis between AH and contextual factors (availability of GPs, the number of hospital beds and gross domestic product [GDP] per capita). In a second step the hospitalisation rates for ACSC in the two countries were analysed using a multilevel mixed effects Poisson regression model. Finally, the findings were compared between the two countries.

Italy has a state-regulated HCS (NHS system) and can relatively easily implement government reforms in the health sector. Germany is a country where policy implementation is supposed to depend more on the cooperation of insurers and providers than on direct governmental decisions (Van der Zee, 2007). Another aspect rests on the fact that high-income countries, like Germany, can afford to base their health care system more on hospital care, which is more resource-consuming, than on PC. (World Health Organization, 2008). However this may create inefficiencies (Pelone, 2012).

5.What is the role of specific GP activities in AH?

In order to validate AH as a measure of health system performance we used the data from the Health Informative System of Latium Region to explore the relationships between hospital admissions for ACSC and a specific set of indicators related to GPs' activities, by using data at individual GP-level. The organisational aspects of the PC were then assessed considering the referrals of specialist visits and prescription of drugs by GPs and emergency department (ED) access of GP patients. Large-scale empirical studies based on linked service data are scarce in this field, but thanks to the available detailed person-level data it has been possible to analyse analytically AH rates in relation to specific health services provided by GPs (Rosano, 2013b).

Methods

In this study the relationship between AH and PC was analysed using regression models, adjusting for factors that the scientific literature has shown to be potentially confounding. Also, contextual factors were considered and analysed using a multilevel model (Leyland & Goldstein, 2001).

As many different sets of ACSC exist, as well as of disease codes used to identify the conditions, for the purpose of the study an adaptation of the ACSC list formulated by Pirani (2006) was used for the Italian context. A group of experts verified the appropriateness of the conditions proposed in the literature to assess the performance of the PC delivery system within the Italian context. The final selection consisted of 14 conditions for adults, used in the present study when analysing the Italian data. The conditions were analysed both separately and grouped according to the different strategies of prevention. In particular, the rates of hospitalisation for acute and chronic conditions were analysed by year of admission using Poisson regression models, adjusting for selected individual risk factors: i.e. patient's age, sex and region of residence. Contextual risk factors such as the number of GPs per 1,000 residents, GDP per capita and the number of beds per 1,000 persons, were selected from the scientific literature and were used in multilevel models.

Specific analyses were conducted by geographic area and by time. Higher rates of ACSC admissions in a given geographic area may depend on insufficiency of PC; maldistribution of PC resources; existence of barriers to accessing PC services;

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problems in continuity of care; and inefficient use of resources (Ansari, 2007). The existence of a time trend in ACSH may reflect changes in PC accessibility and/or quality. The trends of observed versus expected rate ratios were then analysed using a non-parametric test for the analysis of trends developed by Cuzick (1985), which is an extension of the rank test proposed by Wilcoxon.

Data collection

Information on hospital discharges was extracted from the Hospital Discharge Register of the Italian Ministry of Health in an anonymous format. Data on the number of GPs per 1,000 residents and the number of acute hospital beds per 1,000 residents were derived from the Health Informative System of the Ministry of Health.

Regional data on hospitalisation, drug prescriptions, ambulatory services and ED accesses were taken from the Health Informative Systems of the Latium Region, managed by the Agency of Public Health of the Latium Region. German data on hospital discharges were drawn from the Hospital statistics of the Federal Statistical Office. German data on health care resources were derived from the Federal Medical Registry.

Data on contextual characteristics, such as GDP per capita, were taken from the Eurostat nomenclatures of territorial units for statistics (EUROSTAT, 2012). Population characteristics were obtained from the statistics of the resident population supplied by the Institute of National Statistics (ISTAT, 2013).

Outline of the thesis

The results of the thesis are presented in Chapter 2 through Chapter 6. The Chapters are written as separate articles and can be read independently of one another. The content of the chapters may hence overlap, especially with respect to the methods.

Chapter 2 includes a systematic review showing what is known about the relationship between AH and accessibility of PC. In Chapter 3, we examine the trends of AH adjusted for the general trends in hospitalisation rates and test possible associations with measures of PC (re)organisation. In Chapter 4, an article is presented that investigates the distribution of the rates of ACSH in the Italian context – at the regional level – in conjunction with indicators of health status, and the propensity to use hospitals (total hospitalisation) and indicators of PC provision. In Chapter 5, we aim to compare hospital admissions for ACSC in Italy and Germany and to discuss possible relationships with the different models of PC supply. Chapter 6 shows how to validate AH as a measure of health system performance in the Latium region, exploring the relationships between hospital admissions for ACSCs and a specific set of indicators related to GP activities, using individual data.

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Chapter 2

**The relationship between
avoidable hospitalisation and
accessibility to primary care: a
systematic review**

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Chapter 2

Abstract

Background: Avoidable hospitalisation (AH) has been widely studied as a possible measure of the performance of primary health care (PHC). However, studies examining the relationship between efficiency and quality of PHC and AH have found mixed results. Our study aims at highlighting those factors related to the relationship between AH and accessibility to PHC in different countries.

Methods: we conducted a systematic search for published, peer-reviewed studies among English, Spanish, French, Italian and Portuguese language articles published between 1990 and October 2010, using primary electronic databases.

Results: the final analysis was conducted on the basis of 51 papers. 72.5% of them revealed a significant inverse association between the indicator of PHC accessibility and rates of AH. Indicators of PHC calculated at individual level are more likely to reveal contradictory aspects of the relationship between rates of AH and indicators of quality and PHC accessibility.

Conclusions: Most studies confirmed the expected relationship between indicators of PHC accessibility and hospitalisation for ambulatory care sensitive conditions (ACSC), showing lower hospitalisation rates for ACSC in areas with greater access to PHC. The findings allow us to be quite confident when using ACSC hospitalisation as an indicator of primary care quality, with the precaution of considering appropriate adjustment factors.

Keywords: avoidable hospitalisation, primary care, systematic review

Introduction

An avoidable hospitalisation (AH) is one that could have been prevented through the timely and effective utilization of outpatient care. Conditions for which a hospitalisation can be considered avoidable are often referred to as ambulatory care sensitive conditions (ACSCs). ACSCs include chronic diseases, such as diabetes and asthma, and acute diseases, such as pneumonia and appendicitis with complications.^{1,2,3} The occurrence of avoidable hospitalisation has been widely used as an indicator of the quality of diagnosis and treatment in primary care^{4,5} as well as the quality of chronic disease management.⁶ In countries where access to primary care is universal and free at the point of delivery, interest in these conditions aims at measuring mainly the quality of care delivered.⁷

Many authors have highlighted how the relationship between hospitalisation for ACSCs (ACSH) and the quality of primary care are generally strongly influenced by income levels, insurance status, race and ethnicity¹ as well as socio-economic factors (SEF).^{8,9}

The validity of ACSC admissions indicators has been analyzed by the Agency for Healthcare Research and Quality (AHRQ), which has verified its reliability in terms of precision, minimum bias and construct validity.¹⁰ Furthermore there has been a great deal of discussion regarding its usefulness in identifying priority areas in order to improve health access and quality of care in terms of symptom management and supportive relationships, self-management support and service delivery, local infrastructure and socio-economic opportunities.¹¹

Previous studies examining the relationship between primary health care (PHC) supply and ACSH found mixed results: some found the expected inverse association,^{12,13,14} some found a positive association,¹⁵ or no association at all.^{16,17}

Some studies found the expected inverse association in unadjusted results, while in adjusted analysis, the direction of association was also inverse, but not statistically significant.⁴ Research using individuals' coverage by managed care as an indicator of accessibility and PHC quality did find lower rates of hospitalisation for ACSCs in covered subjects.^{18,19} In general, studies have shown that better outpatient care can reduce patient complications, including those leading to admissions for ACSCs.

Results may differ across countries and health care systems (HCS) according to the role of primary care and hospital care: in the Beveridge system the organisation is often part of a pyramid-shaped hierarchical bureaucracy with primary health care at the bottom and high tech hospitals at the top. Access to specialized care is dependent on a referral from a GP: the so-called gate-keeping system; in the Bismarck system the organisation is looser, with less State influence and a more pluralistic structure, with a strong influence of health care providers and (social) insurers. There is often parallel access to primary and specialized care. Care is provided by non-profit hospitals and individual practitioners;²⁰ in the US, because of the lack of universal entitlement to health care benefits in the HCS, uninsured and underinsured persons encounter barriers in obtaining access to primary care. Inside the NHS the use of gatekeepers in primary care increased during the 1990s, but has since been abandoned. There are both private and public insurers in the U.S. health care system with a predominance of the private element.

As well as the role of GPs in terms of gatekeeping may influence the hospitalisation for ACSCs. In countries with a gatekeeping system (GK) patients see a GP before in order to be referred to a specialist. By contrast, in a non-gatekeeping system, individuals can seek help directly from specialists without authorization by a GP.

Analyses of hospitalisations for ACSCs can also serve as a convenient and effective evaluation tool for assessing the effectiveness of interventions aimed at improving

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the quality of primary care. However, the actual interpretation of this indicator may vary across countries, health care systems, geographic areas and population groups. A more comprehensive analysis derived from available scientific evidence may help to make the question clearer and provide useful methodological hints for future studies. Accessibility of PHC is one of the core dimensions of the performance of PHC. Such an “ability to secure a specified set of health care services, at a specified level of quality, subject to a specified maximum level of personal”²¹ is the prerequisite of the “first level of contact of individuals, the family and community with the health system bringing health care as close as possible to where people live and work”, so to keep all PHC practical, scientifically sound and socially tools universally accessible to individuals and families in the community”²². Thus, it's a prerequisite of the overall quality of PHC.

The aim of the present study was to analyze the relationship between AH and measures of accessibility to PHC, both over time and among different health care systems, based on the results of studies conducted from January 1990 to October 2010 selected with a systematic approach.

Methods

We conducted a systematic search of published, peer-reviewed studies published from 1990 to 2010 using a number of primary electronic databases: Pubmed/Medline, CINAHL pre – CHINAL (no restrictions), SCOPUS (no restrictions) databases and Google Scholar. Each electronic search was performed by using a specific combination of subject headings, starting from the Mesh Terms and Pubmed-search-strategy as reported in Box 1 and free text-words. Supplementary scientific articles were searched firstly by using a ‘related citations’ algorithm (both on Pubmed and SCOPUS) and secondly by scanning the reference lists of the most relevant articles retrieved. Articles published up to October 2010 and written in English, Spanish, French, Italian and Portuguese were considered. We only considered primary epidemiological researches (both observational and experimental) and we excluded systematic reviews, overviews of literature and any kind of secondary study.

The search terms yielded 922 titles and abstracts. An abstraction form was developed to confirm eligibility for full review, to assess article characteristics, and to extract data relevant for answering the study's questions. Articles were assigned randomly to three couples of reviewers (AR-GG; RF-CAL; WR-AGdB), who separately screened abstracts of all the references identified. Abstracts were rated independently by each member of the pair of reviewers, and scored for relevance (Relevant/Not Relevant) using the following criteria: having a primary focus on the concept of ACSC; reference to the quality of accessibility of primary health care using a quantitative indicator; having a adequate sample size; having clear information on the health status of those subjects included in the studies. Studies judged not relevant by both reviewers were immediately excluded, those with discordant judgments were discussed together by both reviewers and then reclassified, those judged relevant by both reviewers were immediately included. The second step was to have the complete text of the remaining studies (n=142) reviewed by the same teams to check whether papers met inclusion criteria, using a special form. Through this process 94 studies were excluded because the PHC indicators were not clearly described or because they included cases with specific conditions (depression, mental illness, dementia, cancer) or after specific treatment (surgical) or because they reported insufficient conclusions regarding factorial significance. A total of 48 studies remained, and through bibliographic citations of selected papers a further 3 papers were added. (see Figure 1 for selection process).

Information extracted from the remaining studies (n=51) included: first author and publication date, country of origin, study type, study design, outcome variable (hospitalisation, preventable admission,), type of indicator of PHC quality, inclusion of other variables (in particular socio-economic status or socio-demographic information), health care model, age of subjects, and inverse or positive association with outcome (including significance level if available).

The outcome variable, i.e. hospitalisation for ACSC, was similar and comparable among all selected studies. The list of ACSC conditions was inspired by the one proposed by Weissman¹ and AHRQ²³ with a few variations, especially in European studies. A list of conditions reported in selected papers is available in appendix 1.

In selected studies four types of indicators of PHC quality and accessibility as predictors of preventable hospitalisation were used. It is about of indicators usually adopted by the OECD to measure quality and accessibility of primary care²⁴. Two of them were calculated at group level (number of GPs per 1,000 residents and the availability, presence of community health centers or number of PHC centers in the living area) and two at individual level (number of GP or specialist visits, and access to an enhanced PHC program³). The relationship between primary care accessibility indicators and avoidable hospitalisation reported in the selected studies was analysed. We classified the type of relationship as *positive*, when a significant concordant relationship was found (high PHC accessibility goes with high rates of AH), as *inverse*, when a significant discordant relationship was found, or *no association*, when the relationship between the two factors was not statistically significant. The level of statistical significance was that considered in every single study, usually $p < 0.05$. The presence and the role of SEF as adjusting factor in the relationship between PHC performance and AH reported in selected studies was also described and analysed. The gatekeeping role of GPs in the different countries was also analysed. A detailed register of selected studies with relevant information (country/setting, period, population group investigated, study design, type of indicator, summary of findings) is available in appendix 2.

Results

Out of the 51 articles included in the present review 38 articles (74%) were conducted in countries following the "Private insurance" model, 10 articles (20%) came from countries adopting the Beveridge model and 3 papers (6%) were related to countries with the Bismarck or mixed health care model. The majority of studies were conducted in the USA (38), the others in Spain (4), Canada (2), Brazil (2), the UK (2) and one each in Australia, Italy and New Zealand.

PHC indicators were calculated at individual level in 25 studies and at group level in 26. We plotted the significant and non-significant findings as reported in selected studies for each type of indicator (see Figure 2).

The studies were heterogeneous in study design, incorporating multiple levels of evidence, namely, retrospective cohort studies (n=2), quasi-experimental design (pre-post studies⁴) (n=6); and retrospective database or population studies (n=43).

³ Enhanced PHC programmes are intended programs aiming at increasing the capacity of primary health care providers to provide health service to targeted population.

⁴ Pre-post studies are defined as a "study that examines whether participants in an intervention improve or regress during the course of the intervention, and then attributes any such improvement or regression to the intervention."

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Inverse association between indicators of PHC quality or efficiency and hospitalisation rates of ACSC was found 6 out of 8 studies with capacity to provide stronger evidence, such as cohort and quasi-experimental studies.

By stratifying the analysis according to HCS we found 5 studies out of 10 with a significant inverse association between indicators of PHC accessibility and hospitalisation rates of ACSC in countries with a Beveridge HCS; 3 out of 3 in Bismarck/mixed HCSs and 30 out of 38 in the US HCS. When accessibility to PHC is expressed through the implementation of Enhanced PHC programs an inverse association was found in 9 out of 11 studies (Table 1).

In the US HCS, when considering the population groups involved in the studies we found that in vulnerable groups (children, the elderly, persons covered by Medicaid or Medicare in the USA) 8 out of 23 showed a positive association or no association between PHC indicators and hospitalisation for ACSCs, whereas in 15 studies an inverse association was found. In the overall population or for adults 2 out of 15 revealed a direct association or no association between PHC indicators and hospitalisation for ACSCs, whereas in 13 studies an inverse association was found. In the Beveridge and Bismarck/mixed HCSs only 2 studies focused on vulnerable populations (one with inverse association), 11 studies were conducted on general population (7 found and inverse association) (Table 2).

In 20 studies SEF were considered when analyzing the relationship between PHC indicators and hospitalisation for ACSCs: 4 out of 10 conducted in the Beveridge HCS, 13 out of 38 in the US HCS and 3 out of 3 in the Bismarck/mixed HCS. When adjusting for SEF, in 16 studies an inverse association between PHC indicators and hospitalisation for ACSCs was found: 12 out of 13 in the US HCS, 1 out of 4 in the Beveridge HCS and 3 out of 3 in the Bismarck/mixed HCS. In 4 studies a direct or no association was found. The adjustment for SEF implied a significant variation in values of the quality of primary indicators in 5 studies, no changes in 2 studies. No comparison between adjusted and not adjusted measures was obtainable from 13 out of 20 studies. However, SEF variable were statistically significant factors in 14 out of 20 statistical models used to analyze the relationship between rates of PH and PHC indicators.

GPs act as gatekeepers in Australia, Brazil (for tertiary care), Italy, New Zealand, Spain, UK and not in USA and Canada. Among countries with gatekeeping system the studies put in evidence an inverse correlation between ACHS rates and accessibility in 7 studies and no association in 4 studies. In USA e Canada, where GP have not a gatekeeping role, a positive correlation was found in 5 studies, no association in 4 studied and a inverse association in 31 studies.

Discussion

Findings in studies dealing with hospitalisation for ACSCs and indicators of PHC accessibility and quality were studied in depth using the 51 original articles. With a systematic review approach several factors implied in the relationship between PHC indicators and hospitalisation for ACSCs were then analyzed.

A prior review of the literature regarding this issue, using mainly qualitative evidence and limited to the USA and Australia, showed that most of the studies investigating primary care supply found a statistically inverse significant association between physician supply and ACSC admissions.⁴

Our analysis revealed more interest and editorial production on these issues by researchers in fee for services health systems (38/51). These findings could be attributable to the outstanding heritage of the US public health and health services research school on ACSCs, which we discussed previously. Nevertheless, in all

healthcare systems, those that optimized the performance of their key functions, starting from reducing unnecessary use of expensive specialized care, were likely to maintain their populations healthier, to cause fewer health-related disparities and to produce lower overall costs for health care. Though the evidence is not conclusive yet, particularly not in the Beveridge healthcare settings, we believe that more focused research policy efforts are needed in these contexts too. Our review highlighted the relevance of accessibility of PHC, mostly measured through the availability of GP in a given area and the entitlement of patient to access to GP visits. Even though the majority of studies confirmed the postulated inverse association between indicators of accessibility and PHC quality and hospitalisation for ACSCs, when evaluating the accessibility of PHC at individual level a higher proportion of contradictory results was found. This aspect remains questionable. The indicator “number of specialist visits”, especially in the systems where GPs are gatekeepers, should be interpreted as an indicator of secondary care services. However, as we are focused on factors that help patients to avoid hospitalisation, we could group specialist and GP visits in the same indicator, as many authors have done in their studies.^{25,26,27}

All selected studies but one, when analyzing the enrolment in enhanced PHC programs, showed a lower risk of hospitalisation for ACSCs in enrolled subjects. This lower risk may be due, in part, to a greater use of preventive services in managed care settings if compared to fee-for-service health insurance, although the quality of care in managed care varies widely according to providers, plans, and geographic areas.²⁸

In the US, primary care is increasingly designed around the concept of “disease management”, a form of case management in which packages of healthcare services are designed to manage specific groups such as elderly patients or those with chronic diseases.²⁹ This approach seems to have a real protective effect against AH. Deprivation and poor health conditions are known risk factors for hospitalisation.²¹ Studies conducted among vulnerable groups revealed the possibility of the conflicting interpretation of hospitalisation rates for ACSCs as an indicator of PHC efficiency and quality. In 7 out of 25 studies conducted among vulnerable subjects, independently from the type of HCS, no association or direct association between indicators of accessibility to primary care and hospitalisation rate for ACSCs was found. Furthermore, when using indicators such as socio-economic status to adjust such a relationship, 4 out of 20 studies were not able to confirm the supposed protective action of PHC, as measured with indicators of accessibility both at individual and ecological level.

The barriers to quality primary care for vulnerable populations are numerous and complex. Some authors have postulated that financial obstacles are critical,³⁰ and some authors have even argued that the healthcare system generally has little influence over the admission policies adopted by hospitals.³² The type of HCS appears to have a decisive role in this issue. In the USA middle and lower classes are less likely to receive preventive services, more likely to experience delays in their care, and less likely to have a regular source of care^{3,32}, increasing the need for hospitalisation. In countries that adopted the Beveridge systems deprivation has a limited impact in accessing primary care, specially among children³³.

The gatekeeping system may also play a role: no positive association between AH and accessibility of PHC was found in countries where GPs act as gatekeepers. Gatekeeping may promote appropriate ambulatory care and filter elective hospital care.

Limitations of this study may arise from the characteristics of the primary studies, the revision search strategy, and its main results. The first issue deal with heterogeneity

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in design and outcomes of the original studies. This may result in a spurious summary of findings and misleading conclusions. In fact, particular attention has been devoted to consider also analysis by subgroups of study design and type of outcome. However, heterogeneity in study design and in the issues faced in each study doesn't represent – indeed – itself a weakness. In fact, narrow inclusion criteria that include only those studies reporting a particular outcome, or limited to specific study designs, would run the risk not to consider potentially valuable studies.³⁴

Secondly, even though the search strategy was thorough, some relevant published articles might have been missed because of the specificity of the search strategy that made use of a restricted class of terms.

Thirdly, it was not possible to search the “grey literature” for additional studies. We tried to overcome this limitation by refining our search with the ‘related articles’ search on Pubmed and other electronic databases, supplemented with hand searches of the references of related articles. Finally, we found out that the emphasis on different types of health care systems (Beveridge, Bismarck) was limited because of the predominance of American studies.

We can conclude that the majority of studies confirmed the expected relationship between indicators of PHC accessibility and hospitalisation for ACSCs, even though when indicators of PHC quality and efficiency measured at individual level are considered, more contradictions in the interpretation of the relationship are found. The adjustment for socio-economic status appears to be a fundamental aspect regarding this issue.

Conflicts of interest: none declared

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Table 1. Association between PHC indicators and hospitalisation for ACSCs according to health care system (HCS).

HCS	Type of indicator	Type of association			Total
		Positive	No association	Inverse	
HCS: Beveridgian	Enhanced PHC		1	2	3
	GP visits	1	1	1	3
	Number GPs		2	2	4
	<i>Subtotal</i>	1	4	5	10
Bismarck/mixed HCS	GP visits			1	1
	Number GPs			2	2
	<i>Subtotal</i>			2	3
US HCS	Enhanced PHC	1		7	8
	GP visits	2	1	8	11
	Number GPs	1	3	7	11
	Presence PHC center			8	8
	<i>Subtotal</i>	4	4	30	38

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Table 2. Association between PHC indicators and hospitalisation for ACSCs according to population group by Health Care System (HCS).

US HCS	<i>Positive</i>	<i>No association</i>	<i>Inverse</i>	<i>Total</i>
Overall population	1	1	13	15
Vulnerable population	3	3	17	23
HCS: Beveridge				
Overall population	1	3	4	8
Vulnerable population		1	1	2
HCS: Bismarck/mixed				
Overall population			3	3
Vulnerable population				0

Vulnerable population include: children, the elderly, persons covered by Medicaid or Medicare in the USA

BOX 1. Search strategy

QUALITY	"outcome and process assessment health care/organisation and administration"[All Fields] OR "outcome and process assessment health care/methods"[All Fields] OR "outcome and process assessment health care/standards"[All Fields] OR "regional health planning"[All Fields] OR "utilization review/methods"[All Fields] OR "national health programs"[All Fields]
	OR
	Outcome and Process Assessment Health Care[Mesh] OR "Utilization Review"[Mesh] OR "Regional Health Planning"[Mesh] OR "National Health Programs"[Mesh]
AND	
AVOIDABLE HOSPITALISATION	"avoidable hospitalisation"[Title/Abstract] OR "avoidable hospitalisation conditions"[Title/Abstract] OR "avoidable hospitalisation rates"[Title/Abstract] OR "avoidable iatrogenic complications"[Title/Abstract] OR "preventable hospitalisation"[Title/Abstract] OR "preventable hospitalisation rates"[Title/Abstract] OR "preventable hospitalisations"[Title/Abstract]
	OR
	"Hospitalisation"[Mesh] OR "Patient Admission"[Mesh] OR "Patient Readmission"[Mesh]
AND	
CODING PROCEDURES	"DRG"[Mesh] OR "Forms and Records Control"[Mesh] OR "ICD"[Mesh] OR "Severity of Illness"[Mesh] OR "Medical Records"[Mesh])
	OR
	"international classification of disease codes"[All Fields] OR "international classification of diseases/classification"[All Fields] OR "international classification of diseases/organisation and administration"[All Fields] OR "severity of illness index/methods"[All Fields] OR "severity of illness indices"[All Fields] OR "severity of illness measures"[All Fields] OR "severity of illness scores"[All

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	Fields] OR "severity of illness systems"[All Fields] OR "medical records/organisation and administration"[All Fields] OR "medical records/classification"[All Fields]
AND	
PRIMARY CARE	Primary Health Care[Mesh] OR "Hospitals, Community/utilization"[Mesh] OR "Outpatient Clinics, Hospital"[Mesh] OR "Managed Care Programs"[Mesh]
	OR
	"primary care"[Title/Abstract] OR "managed care program"[Title/Abstract] OR "managed care programs"[Title/Abstract]) AND (French [lang] OR Italian [lang] OR spanish [lang]) OR "ambulatory care"[Title/Abstract]
AND	
AMBULATORY CARE SENSITIVE CONDITIONS	ambulatory care sensitive conditions[Title/Abstract] OR "ambulatory care sensitive disorders"[Title/Abstract] OR "ambulatory care sensitive hospital"[Title/Abstract] OR "ambulatory care sensitive hospital discharge rates"[Title/Abstract] OR "ambulatory care sensitive hospitalisations"[Title/Abstract] OR "ambulatory care sensitive hospitalisation rates"[Title/Abstract]
	OR
	"Appendicitis"[Mesh] OR "Urinary Tract Infections"[Mesh] OR "Pulmonary Disease, Chronic Obstructive"[Mesh] OR "Asthma"[Mesh] OR "Dyspnea, Paroxysmal"[Mesh] OR "Angina Pectoris"[Mesh] OR "Microvascular Angina"[Mesh] OR "Cellulitis"[Mesh] OR "Heart Failure"[Mesh] OR "Epilepsy, Tonic-Clonic"[Mesh] OR "Dehydration"[Mesh] OR "Diabetes Complications"[Mesh] OR "Gangrene"[Mesh] OR "Gastroenteritis"[Mesh] OR "Hypertension"[Mesh] OR "Pneumonia, Pneumocystis"[Mesh] OR "Anemia, Iron-Deficiency"[Mesh] OR "Infant, Low Birth Weight"[Mesh] OR "Malnutrition"[Mesh] OR "Pelvic Inflammatory Disease"[Mesh] OR "Otorhinolaryngologic Diseases"[Mesh] OR "Ear Diseases"[Mesh] OR "Nose Diseases"[Mesh] OR "Peptic Ulcer"[Mesh])

Figure 2: Significance and direction of the relationship between hospitalisation for ACSCs by type of indicator of accessibility to Primary Health Care (PHC).

Chapter 3

Trends in avoidable hospitalisation rates in Italy, 2001– 2008

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Abstract

Background: Hospitalisation for Ambulatory Care Sensitive Conditions (ACSC), also known as potentially avoidable hospitalisation (AH) has been proposed as effect measure of the accessibility and effectiveness of primary health care. In the last years in developed countries, including Italy, hospitalisation rates have decreased as well as the rates of avoidable hospitalisation. Such a decline of AH-rates could just be an effect the of general trend of hospitalisation. The objective of our study is to examine the trends of AH adjusted for the general trend in hospitalisation rates and to test possible associations with measures of primary care (re)organisation.

Data and methods: Hospital discharge data from 2001 to 2008 were analysed. Main outcome measures were hospitalisation rates, both as inpatient and day hospital care. ACSCs were grouped in acute conditions, preventable through early diagnoses (and treatment) and chronic conditions, preventable through good ongoing control and management. Expected time-series rates of AH, estimated on the hypothesis of same time trends of total hospitalisation, were compared with observed ones using a chi square test. Adjusted hospitalisation rates were analysed in conjunction with indicators of primary care.

Results: In the studied period, in Italy, the overall hospitalisation rates declined with an average decrease of 19,6%, while the decrease for AH was 16,4%. The rates of AH adjusted for the trend of total hospitalisation significantly decreased only for chronic conditions. The decreasing trend of AH was correlated with the impact of reorganisation of primary care.

Conclusions: The presented methodology can be used to evaluate the real effectiveness of policies tended to reduce hospitalisation for avoidable conditions.

Keywords: avoidable hospitalisation, primary care, time trends,

Background

Many diseases, both chronic and acute, once treated in hospital, can now be more appropriately handled in primary care [1]. This results in a benefit, both for patients and for the hospital organisation, which can be better devoted to urgent and intensive care. Potentially avoidable hospitalisation (AH) refers to a hospitalisation for conditions which could be appropriately and timely prevented or treated through the management and control in a less intensive level of care. Those conditions are known as Ambulatory Care Sensitive Conditions (ACSC) [2]. Admissions for ACSCs represent a distinct health outcome from inappropriate admissions, defined as admissions for problems that could be treated on an out-patient basis [3]. It is, in fact, about events for which the appropriateness of admission itself is not questionable, but the fact that the patient could avoid the recourse to the hospital if he/she had been adequately treated by primary care services [4].

It has been shown that patients who have better access to primary care are less likely to be hospitalized for ACSCs [5-9]. The hospitalisation rate for AH has been suggested as effect of prompt access and quality of outpatient care and, in general, of primary care [10].

Hospitalisation rate for ACSCs can be a measure of Primary Health Care's (PHC) capability to solve health problems, although the expected effect on potentially avoidable hospitalisations will differ depending on the conditions being treated. Hospitalisations should be essentially eliminated for diseases that can be prevented either by early diagnosis and treatment of the disease precursor (e.g. rheumatic fever) or at the early stages of the natural course of the disease (e.g. pelvic inflammatory disease). On the other hand, for chronic conditions the most immediate result should be decline of the occurrence of acute complications (e.g. coma in diabetic patients) [11].

Thus, ACSCs are used to be grouped in two different lists of conditions: the first includes conditions that are supposed to be prevented through early diagnoses (and treatment) of the condition or its precursor; the latter through good ongoing control and management.

In Italy, hospitalisation rates for ACSCs have decreased in the last years [12] as well as general hospitalisation rates. Therefore, it is likely to observe also a decrease in hospitalisation attributable to ACSCs. The extent to which differences in rates of ACSC hospitalisations is associated with differences in the strength of the PHC organisation appears to be worth exploring, since these hospitalisations have been considered a potential effect of the quality of PHC received.

Day-Hospital (DH) admissions are used for interventions or procedures to treat acute or chronic conditions which do not require a overnight stay in hospital. In the past DH admissions has been often used also for diagnostic purposes, specially for complex chronic conditions. The shift to day hospital admissions is used as an indicator of the evaluation of the hospital care [13]. In more recent years, many regions have moved all diagnostic procedures to the ambulatory setting.

The number of GPs per 1,000 residents and the number of ambulatory visits per 1,000 residents has been widely used to analyse the relationship between AH and accessibility of primary care [14].

Since 2000 an innovative form of primary care delivery has been developing: the primary care in association. It is constituted by a pool of GPs who decide to share structures, facilities and decide to collaborate in common projects. The main benefits that medicine in association guarantees can be summarized in: continuity of care; availability of GPs for more hours per day and days per week; adherence to

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guidelines and innovative projects; prevention of avoidable access to ED and hospital admissions. The percentage of GPs involved in associative networks increased (nationwide) in the study period (from 59% in 2004 to 65% in 2009), specially in Toscana, Campania, Lombardia and Abruzzo [15]. Study period is 2001-2008.

Several factors are known to be associated with the occurrence of AH, such as socioeconomic status of patients, the prevalence of the disease [16]. They are not supposed to change significantly over the eight years under analysis and thus were not considered in the present study.

Aim of this study

The goal of the study is to examine the trend of hospitalisation rates for AH in Italy and to verify to which extent the trend is attributable to reduction in hospital use or to specific factors underlying the AH. We also tested the relationship between hospitalisation rates for AH and indicators of primary care access, by investigating whether new measures of health care management, specifically delivering primary care by GPs in associative form, have had an impact on overall hospitalisation and/or specifically on AH.

Material and methods

Sources of data

Hospitalisation data are collected, in aggregate, from the archive of hospital discharge records of the Ministry of Health and refer to discharges registered between January 1, 2001 and December 31, 2008. Population data for the years 2001-2008 were extracted from the archive available online by the National Institute of Statistics - ISTAT [17]. Information on primary care delivery (number of GPs per 1,000 residents, number of diagnostic imaging tests per 1,000 residents, proportion of GPs in association) was drawn from the Osservasalute database [18].

Selection of diagnoses

For the purposes of the study 59,374,201 hospitalisations in acute care wards referred only to patients aged over 18 years were selected. Admissions for DH were also separately investigated. The choice of not including pediatric admissions is due to the fact that it is difficult to argue the avoidability of hospitalisation among children whether this is the case of the first event to be treated in emergency, that only subsequently would require a follow-up and clinical care as outpatient, such as for episodes of asthma.

The selection of diagnoses for ACSC was conducted according to the criteria defined in a previous study [19], where those selected in the American [2] and European [20] context were adapted to the Italian one. The selected ACSCs are reported in Table 1, classified according to two different strategies of prevention: early diagnoses and treatment of the condition (acute conditions - group 1); appropriate follow-up and good management of chronic disease (chronic conditions - group 2).

Statistical analysis

We calculated the age-standardized rates per 1,000 persons of avoidable hospitalisations (ASAH). Denominators were defined as the population at the beginning of the reporting year. The reference standard population is the resident population in Italy on the 1st of January 2005. To take into account the propensity to

hospitalisation, the expected rates of avoidable hospitalisations adjusted for the general trend of hospitalisation were calculated. The expected rates of AH were estimated for the years 2002-2008 on the basis of the percentage annual variations observed in the time series of general hospitalisation rates. The trends of observed expected rate ratio were then analysed using the non-parametric test for the analysis of trend developed by Cuzick (21), which is an extension of the rank test proposed by Wilcoxon. The level of significance was set at 5%.

Joinpoint regression analyses (version 2.7) (22) were used to assess changes in ASAH, as well as general hospitalisation, both as inpatient admissions and DH, over time. This procedure, also known as piecewise or segmented regression, fits a model based on the minimum number of joinpoints (points of change in slope) that are observable across a series of rates over time. In this analysis, the unit of analysis is the year, with eight data points being represented (i.e., 2001–2008). Hospitalisation rates by year were then analysed in relationship with the primary care indicators (number of GPs, number of diagnostic imaging tests and percentage of GPs in association) using a non parametric correlation index: the Spearman index (S-index).

Results

In the study period about 4.8 million hospital admissions for ACSCs were registered in Italy, accounting for 8% of total hospitalisation. The decrease in the overall rate of hospitalisation in the period 2001-2008 was 19.6%, while that for avoidable conditions was 16.4%; rates of DH hospitalisation increased from 58 per 1,000 in 2001 to 69 per 1,000 in 2005 and then decreased to 59 per 1,000 in 2008 (Graph 1). The trend of AH rates, when adjusted for general hospitalisation, did not reveal any significant slope ($p > 0.05$). If we consider separately hospitalisation rates for avoidable acute and chronic conditions, the trend of adjusted rates was slightly increasing for acute conditions and decreasing for chronic conditions.

According to the joinpoint regression results, as for total hospitalisations, the trend is significantly decreasing with no significant joinpoint throughout the time interval (JP = 0, slope = -0.049, $p < 0.05$). The avoidable hospitalisation rates depict the same trend, showing statistically significant declines, with no significant joinpoint (JP) throughout the time interval (JP = 0, slope = -0.025, $p < 0.05$) (data not shown). When analyzing AH for chronic conditions we found a significant decrease with one significant joinpoint at year 2005 (JP = 1, slope 2000-2004 = -0.26 slope 2005-2008 = -0.21, $p < 0.05$) (Graph 2a) as well as for hospitalisation rates for DH (JP = 1, slope 2000-2003=5.09 slope 2004-2008 = -2.08, $p < 0.05$) (Graph 2b).

Primary care delivery in association and adjusted rates of avoidable hospitalisation

We tested the correlation between hospitalisation rates time series both for ACSCs, separately for acute and chronic conditions, and total hospitalisation (separately for inpatient and DH admissions) with the percentage of GPs in association, the number of GPs, the number of diagnostic imaging tests. We found a significant correlation between hospitalisation rates and the percentage of GPs in association increasing in time for avoidable chronic conditions (from S-index= -0,35 in 2001 to S-index=-0,49 in 2008), decreasing for avoidable acute conditions (from S-index=-0,42 in 2001 to S-index=-0,22 in 2008). We also found a significant inverse correlation between the number of imaging diagnostic tests and the rates of hospitalisation for avoidable chronic conditions (from S-index=-0.49 in 2001 to S-index=-0.40 in 2008).

Discussion

The study aimed at analyzing the trend of AH rates in the period from 2001 to 2008, adjusted for the tendency of general hospitalisation, in order to disentangle what happens in AH from general hospitalisation.

The hospitalisation for ACSCs can be used to interpret the capacity to provide good quality primary care and ensure continuity of care through a more effective and appropriate management of diseases in order to avoid complications and exacerbations of diseases. Generally speaking, even though non-avoidable hospitalisations constitute the majority of hospitalisations (i.e. around 92%) with AH constituting the remaining 8% of hospitalisations, in absolute terms the phenomenon of avoidable hospitalisation has a considerable dimension: 4,8 million admissions in the eight years analyzed, for an average of about 600 000 admissions per year. As well as general hospitalisation "avoidable" hospitalisation showed a decrease in the studied period, although less marked than general hospitalisation.

Avoidable admission rates did not decrease deeper than the general hospital admission rate in the studied period. Looking at AH we observed that acute avoidable conditions and chronic conditions showed different patterns: slightly increasing the first, decreasing, even if not significantly, the latter. The decrease in AH rates was due mainly to the sharp reduction of the number of admissions for diabetes (-40%), angina pectoris (-37%) and COPD (-32%).

The breaking point of the AH rate at the year 2005 could be interpreted in conjunction with the increase of admission for DH observed until 2005 and the drastic drop afterward. Rates of inpatient hospitalisation can decrease through higher DH use, specially for those conditions once treated as inpatients and then transferred in DH. It is about conditions and procedures (e.g. diagnosis of chronic diseases) that often coincide with ACSCs. The introduction of limitations for the admission in overnight stay of a list DRGs (see DPCM 29/11/2001 on the "essential level of care" [Livelli Essenziali di Assistenza], that specifies which benefits are guaranteed by the National Health Care System in terms of positive list and negative list, in primary, secondary and tertiary care, respectively) induced their shift to DH care setting. This may explain to some extent the sharp decrease of admissions of AHR for chronic conditions found in the joinpoint regression analysis, with the peak in 2005. The percentage of admissions in DH was 25% in 2001, became 32% in 2005 and then decreased to 29% in 2009 [23]. The decrease of DH admissions observed after 2005 is attributable to the introduction of regional rules that authorized the provision in the ambulatory setting of DRGs included in the 2001 list [24].

A particular consideration should be given to whether a higher proportion of current DH care could be delivered in alternative, less complex settings. An examination of this should ensure care to be delivered in the most clinically appropriate and cost-effective setting, enhancing primary care capacity to treat chronic and acute avoidable conditions.

The present study allowed to highlight the changes in the access to hospital for potentially preventable causes that it is more likely attributable to an increase in efficiency of primary care, depurating the trend of AH rates from the trend of general hospitalisation rates. A similar approach was used by Clouthier-Fisher and colleagues [25], who tried to analyze what happened in British Columbia (Canada) with avoidable hospitalisation rates (AHR), comparatively to non-avoidable hospitalisation rates (non AHR) and total hospitalisation rates (THR), over the period 1990-2000. Comparing the slopes of trends across categories (AHR, non AHR and Total HR) the authors found statistically significant declines in all hospitalisations

(both avoidable and non-avoidable) over the time period. However when comparing total AHRs to total non-AHRs the difference in slopes was not significant.

In the study period in Italy has been growing a new organisation of primary care delivery, called “primary care in association”. By analyzing the correlation between the proportion of GPs in association and the time series of hospitalisation rates (total, avoidable acute conditions, chronic avoidable conditions) we observed a significant correlation, both with avoidable acute conditions and with avoidable chronic conditions.

Limitations of our study derive from the fact that factors which may be independently associated with the risk of hospitalisation regardless of ‘primary care’ provision, such as comorbidities, characteristics of the population, of patients, of the health care organisation, were not considered. Further limitations may derive from coding procedure of diagnoses, which may vary along the years [26]. This may cause some bias in the interpretation of time variability. In addition, no further information is available on the size and the form of “primary care in association” (peer networks, wired networks, co-working).

The analysis allows, even with reported limitations, some considerations about the trend AH rates, taking into account an important element of context, such as the propensity to use the hospital setting for the care of patients. The decline in AHRs for chronic conditions may be interpreted in a positive light, suggesting that access to effective primary care is improving.

In terms of efficiency, the decline of hospitalisation rates (ie, AHR, and non-AHR and Total HR) also suggests the possibility that the costs were reduced in the acute care sector. On the system perspective, it may be that any savings due to declining admissions and shorter lengths of stay are a product of smaller capacity (ie. fewer beds), however the health status of Italian population does not seem to be affected. In a system where the access to health service is more balanced, with patients treated in the appropriate setting, everybody benefits and saved costs may make available resources to provide more preventive care and for medical research.

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Chapter 3

Table 1. List of Ambulatory care sensitive conditions: definitions, codes and exclusion

ACS conditions by group	ICD-9-CM codes	Exclusion
<i>Group 1 Conditions preventable through early diagnosis and treatment</i>		
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	
<i>Group 2 Treatable conditions through good ongoing control and management</i>		
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	
B7: COPD	466.0, 490-2,, 494, 496	

Graph 1 – Overall standardized rate of inpatient hospitalisation (TH) and Day-Hospital (DH) and standardized rate of hospitalisation for preventable conditions (AH) per 1,000 persons- Year 2001-2008

Data source: Ministero della Salute. SDO - Istat. www.demo.istat.it. Anno 2010.

Legenda of Graph 1

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Graph 2a. Joinpoint Regression Best-Fit Lines for Avoidable Hospitalisation Rates for chronic conditions. Rates per 100,000. Year 2001-2008

Graph 2b. Joinpoint Regression Best-Fit Lines for DH. Rates per 100,000. Year 2001-2008

Chapter 4

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

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Abstract

Background: Hospitalisation 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 hospitalisation 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 the different regions.

Key words: 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 hospitalisations 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 hospitalisations 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 hospitalisations tend to be higher [7]. Hospitalisation 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. Hospitalisation for ACS conditions, also known as potentially avoidable hospitalisation, 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 hospitalisations for these conditions indicate potential opportunities for improving the health system's effectiveness and efficiency.

A previous study, regarding hospitalisation in southern regions of Italy, showed that the proportion of patients who had a preventable hospitalisation 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 hospitalisation for ACSCs. GPs have a key role in preventing hospitalisations 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

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investigated the relationship between hospitalisation 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 hospitalisation [12]. We used the principal diagnosis for each hospitalisation, 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 hospitalisation episodes, which includes administrative and clinical data that all public and private hospitals are required to report. We used hospitalisations 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 hospitalisation 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 hospitalisations per 1,000 of the resident population. We considered total hospitalisation 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 hospitalisation 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 hospitalisation at regional level. We used a categorization of the rate of total hospitalisation on the basis of quartiles of specific rates by age, sex and region. The propensity to hospitalisation was considered as low (rate $\leq 25^{\circ}$ percentile), medium (25° percentile < rate $\leq 50^{\circ}$ percentile), high (50° percentile < rate $\leq 75^{\circ}$ percentile), very high (rate > 75° percentile).

Further analyses were conducted considering the rates of hospitalisation for two specific conditions, pneumonia and diabetes, selected because of their high incidence. In order to analyse hospitalisation 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 hospitalisation 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 especially 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 records 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 hospitalisation and prevalence of conditions. We then analyzed the relationship between standardised rates of hospitalisation by gender and quantitative measures of primary care services, specifically the number of GPs per 1,000 persons and the number of

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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, hospitalisation for pneumonia showed higher percentages than in the southern regions whilst hospitalisation due to diabetes showed lower percentages in the north compared to the south. In general, among hospitalisations 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 hospitalisation rates for acute ACSC by age group, sex and region were described in table 4 part A .

Hospitalisation rates for acute ACSs 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 hospitalisation rates for acute ACSCs for the age group ≥ 75 years that were higher in northern regions than in southern regions.

Hospitalisation rates for chronic ACSCs by age group, sex and region were described in part B of table 4. The hospitalisation 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, especially 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 (M) <45 , M 45-64, M 65-74, M ≥ 75 , Female (F) <45 , F 45-64, F 65-74, F ≥ 75 .

Using the Piedmont region as a reference we observed significantly higher rates of hospitalisation for acute ACSCs, stratified by age, sex and adjusted for propensity to hospitalisation, 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 hospitalisation 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 hospitalisation for acute conditions compared to males). The influence of the propensity to hospitalisation 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 hospitalisation (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 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 hospitalisation 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 hospitalisation 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 hospitalisation and prevalence of the condition in the population, we found similar results, although only the estimated hospitalisation 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 hospitalisation 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.

Discussion

Primary care plays a different role in the prevention of hospitalisation 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 between the provision of primary care and hospitalisation 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 supplied by regional health services.

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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 [24]. 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 [25]. The study revealed a certain heterogeneity in the ACSCs-HR among Italian regions. As hospitalisation may be affected by many concomitant conditions such as population health needs patterns, regional health policies, the level of utilization of health services, and appropriateness and equity in the utilization of services, the analysis of ACSC 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 [26]. In our study, hospitalisation 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, hospitalisation 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 hospitalisation, a deficiency of primary health care services can be presumed. The impact of the organisation 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 [22].

In the analysis of hospitalisation 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 hospitalisation 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 diagnostic specialist care services, were related to hospitalisation 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 [23]. Nevertheless they showed an opposite regional pattern with Northern regions having more specialist services and less GPs, converse 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 hospitalisation 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 hospitalisation 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 hospitalisation 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 organisation 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 hospitalisations by using individual information, adjusted for demographic risk factors whilst simultaneously considering contextual factors, measured at a regional level, such as the propensity to hospitalisation 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 hospitalisation for diabetes and pneumonia. When analysing the regional ACSCs-HR adjusted for the propensity to hospitalisation, sex and age distributions, the regional crude risks of hospitalisation did not differ too much from the adjusted ones. This should mean that variability for those factors do not explain the large variation of hospitalisation 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 hospitalisation 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 hospitalisation is often induced by the scarce continuum of healthcare planning and of outpatient healthcare services (OHCS), that have no incentive for avoiding hospitalisation. When a patient has a complex health problem, hospitalisation 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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Chapter 4

Table 1. List of Ambulatory care sensitive conditions: definitions, codes and exclusions

ACS conditions by group	ICD-9-CM codes	Exclusion
<i>Group 1 Conditions preventable through early diagnosis and treatment</i>		
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	
<i>Group 2 Treatable conditions through good ongoing control and management</i>		
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	

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

	Total admissions	ACSCs		acute ACSCs		chronic ACSCs	
	N	n	%	n	%	n	%
Males	3,324,044	239,040	7.2	86,875	36.3	152,165	63.7
Females	3,930,623	239,767	6.1	84,008	35.0	155,759	65.0
Total	7,254,667	478,807	6.6	170,883	35.7	307,924	64.3

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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	28019
V. 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	74511
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	4714
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	4182
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	40764
FVG	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	13276
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	14715
Em. Rom.	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	40784
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	32992
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	7234
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	15373
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	41017
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	12059
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	3895
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	35044
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	33181
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	4996
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	17136
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	40663
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	13466
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	478808

Legenda

*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-Hypertension; B4-Angina pectoris; B5-Heart failure; B6-Asthma*

Table 4A. Age specific and standardized (SR) admission rates per 1000 persons by group of ACSCs and Region. - Acute Conditions - Males

Region	Age classes					SR
	17-44	45-64	65-74	≥75	All	
Piemonte	0.90	2.20	6.20	18.70	3.70	3.50
Valle D'aosta	1.00	1.90	4.80	16.80	3.00	3.10
Lombardia	1.00	2.30	7.40	21.80	3.70	4.00
Bolzano	1.40	3.60	13.40	45.00	6.30	7.30
Trento	1.10	2.10	7.00	22.10	3.70	3.90
Veneto	0.90	2.30	7.40	28.70	4.20	4.50
Friuli-Venezia Giulia	1.00	2.60	8.80	33.30	5.40	5.10
Liguria	1.10	1.80	5.40	16.50	3.70	3.10
Emilia-Romagna	1.10	2.20	7.20	23.70	4.50	4.00
Toscana	1.00	2.10	6.80	21.60	4.20	3.70
Umbria	1.10	2.20	7.20	19.00	4.20	3.60
Marche	1.00	2.60	7.90	25.90	5.00	4.40
Lazio	1.10	2.30	7.20	17.40	3.50	3.60
Abruzzo	1.30	2.80	8.60	17.30	4.20	4.00
Molise	1.20	3.70	11.10	24.00	5.60	5.10
Campania	0.90	2.00	5.90	11.20	2.40	2.80
Puglia	1.10	2.50	7.60	17.10	3.50	3.70
Basilicata	1.20	2.40	6.30	17.90	3.70	3.60
Calabria	1.10	2.40	6.10	11.20	2.90	3.00
Sicilia	1.10	2.20	5.80	12.90	3.00	3.00
Sardegna	1.40	3.00	8.60	22.10	4.20	4.50
Italy	1.00	2.30	7.00	19.80	3.70	3.70

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Table 4A. Age specific and standardized (SR) admission rates per 1000 persons by group of ACSCs and Region. - Acute Conditions - Females

Region	Age classes					SR
	17-44	45-64	65-74	≥75	All	
Piemonte	1.60	1.30	3.30	10.70	3.10	3.00
Valle D'aosta	1.90	1.60	2.80	10.50	3.10	3.10
Lombardia	1.80	1.60	3.70	12.70	3.40	3.40
Bolzano	3.10	2.50	7.20	24.30	5.90	6.30
Trento	1.50	1.40	4.10	12.40	3.30	3.20
Veneto	1.60	1.40	3.80	18.50	4.10	4.10
Friuli-Venezia Giulia	1.50	1.50	4.00	22.40	5.30	4.50
Liguria	2.20	1.50	3.00	11.00	3.70	3.20
Emilia-Romagna	2.00	1.60	3.80	15.70	4.30	3.90
Toscana	1.50	1.40	3.40	12.30	3.50	3.10
Umbria	1.80	1.50	3.80	10.50	3.40	3.10
Marche	1.60	1.70	4.00	15.30	4.10	3.70
Lazio	1.60	1.50	3.60	10.50	2.90	3.00
Abruzzo	2.10	2.10	4.40	10.90	3.70	3.60
Molise	2.00	2.20	5.20	11.90	4.00	3.80
Campania	1.40	1.40	3.30	5.60	2.00	2.20
Puglia	1.80	2.00	4.50	11.50	3.30	3.50
Basilicata	1.20	1.50	3.70	8.70	2.60	2.70
Calabria	1.60	1.90	3.60	6.90	2.60	2.70
Sicilia	1.50	1.50	3.50	7.50	2.50	2.60
Sardegna	2.60	2.10	5.00	14.30	4.00	4.40
Italy	1.70	1.60	3.70	12.20	3.30	3.30

Table 4A. Age specific and standardized (SR) admission rates per 1000 persons by group of ACSCs and Region. - Acute Conditions – Males + Females

Region	Rates	SR
Piemonte	3.40	3.20
Valle D'aosta	3.10	3.00
Lombardia	3.50	3.60
Bolzano	6.10	6.70
Trento	3.50	3.50
Veneto	4.20	4.20
Friuli-Venezia Giulia	5.30	4.70
Liguria	3.70	3.20
Emilia-Romagna	4.40	4.00
Toscana	3.80	3.40
Umbria	3.80	3.40
Marche	4.50	4.10
Lazio	3.20	3.30
Abruzzo	4.00	3.80
Molise	4.80	4.40
Campania	2.20	2.50
Puglia	3.40	3.60
Basilicata	3.10	3.20
Calabria	2.80	2.80
Sicilia	2.70	2.80
Sardegna	4.10	4.40
Italy	3.50	3.50

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Table 4B. Age specific and standardized (SR) admission rates per 1000 persons by group of ACSCs and Region. - Chronic Conditions – Males

Region	Age classes					SR
	17-44	45-64	65-74	≥75	All	
Piemonte	0..3	2..9	9..6	23..1	4..5	4..2
Valle D'aosta	0..3	3..4	13..0	27..0	5..0	5..1
Lombardia	0..7	4..7	15..5	34..6	6..2	6..7
Bolzano	0..6	4..1	16..7	41..8	6..2	7..2
Trento	0.70	4.40	15.80	45.00	7.00	7.40
Veneto	0.60	4.20	15.20	40.10	6.40	6.80
Friuli-Venezia Giulia	0.40	3.80	15.70	43.30	7.30	6.90
Liguria	0.60	3.60	13.00	32.50	7.10	5.60
Emilia-Romagna	0.60	4.10	13.70	37.60	7.10	6.30
Toscana	0.50	3.80	13.20	36.10	6.90	6.00
Umbria	0.70	3.70	14.00	31.00	6.70	5.70
Marche	0.50	4.20	15.70	40.90	7.80	6.80
Lazio	0.70	4.80	15.10	34.20	6.40	6.50
Abruzzo	0.70	5.10	17.90	33.20	7.40	6.90
Molise	0.80	6.50	22.40	54.60	10.80	9.60
Campania	0.70	5.30	16.60	29.50	5.60	6.50
Puglia	0.70	5.80	17.80	33.70	6.70	7.10
Basilicata	0.70	5.30	17.30	35.40	7.30	7.10
Calabria	0.80	6.20	19.50	39.00	7.80	8.00
Sicilia	0.80	6.70	20.10	35.20	7.70	7.90
Sardegna	0.90	4.10	13.90	34.60	5.80	6.30
Italy	0.70	4.70	15.30	34.70	6.50	6.50

Table 4B. Age specific and standardized (SR) admission rates per 1000 persons by group of ACSCs and Region. - Chronic Conditions – Females

Region	Age classes					SR
	17-44	45-64	65-74	≥75	All	
Piemonte	0..3	1..5	5..3	17..5	3..9	3..6
Valle D'aosta	0..1	1..3	6..2	20..0	4..1	3..9
Lombardia	0..5	2..3	8..7	27..1	5..6	5..7
Bolzano	0..5	2.80	9.20	35.70	6.40	7.00
Trento	0.40	2.60	9.50	31.30	6.50	6.30
Veneto	0.40	2.00	7.90	31.10	6.00	5.90
Friuli-Venezia Giulia	0.30	1.80	7.80	36.50	7.70	6.40
Liguria	0.50	1.80	6.50	26.90	6.70	5.10
Emilia-Romagna	0.40	2.00	8.40	31.70	7.00	6.00
Toscana	0.50	2.00	7.90	30.30	6.80	5.80
Umbria	0.50	1.80	6.90	23.80	5.60	4.80
Marche	0.40	2.10	9.30	32.30	7.10	6.30
Lazio	0.50	2.90	9.80	29.30	5.90	6.30
Abruzzo	0.40	3.00	11.80	29.00	6.90	6.50
Molise	0.50	4.20	13.80	36.30	8.90	8.20
Campania	0.60	3.70	12.90	25.00	5.40	6.50
Puglia	0.60	4.30	14.90	30.60	6.80	7.70
Basilicata	0.40	3.30	15.60	28.60	6.90	7.10
Calabria	0.60	4.40	17.00	34.30	7.80	8.40
Sicilia	0.70	4.60	15.90	29.60	7.20	7.80
Sardegna	0.80	2.90	10.10	25.90	5.40	6.10
Italy	0.50	2.80	10.00	28.40	6.20	6.20

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Table 4B. Age specific and standardized (SR) admission rates per 1000 persons by group of ACSCs and Region. - Chronic Conditions – Males + Females

Region	Rates	SR
Piemonte	4..2	3..9
Valle D'aosta	4..5	4..5
Lombardia	5..9	6..1
Bolzano	6.30	7.10
Trento	6.80	6.80
Veneto	6.20	6.30
Friuli-Venezia Giulia	7.50	6.60
Liguria	6.90	5.30
Emilia-Romagna	7.00	6.20
Toscana	6.90	5.90
Umbria	6.10	5.30
Marche	7.50	6.60
Lazio	6.10	6.40
Abruzzo	7.10	6.70
Molise	9.80	8.90
Campania	5.50	6.50
Puglia	6.80	7.40
Basilicata	7.10	7.10
Calabria	7.80	8.20
Sicilia	7.40	7.80
Sardegna	5.60	6.20
Italy	6.30	6.30

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

	Acute conditions		p - value	Chronic conditions		p - value
Variables	Crude RR	Adjusted RR		Crude RR	Adjusted RR	
Sex and Age						
Males 17-44 (ref.)	1.00	1.00		1.00	1.00	
45-64	2.20	1.67	0.00	7.11	4.21	0.00
65-74	6.73	3.14	0.00	23.38	8.33	0.00
≥75	19.00	8.71	0.00	52.85	18.43	0.00
Females 17-44	1.62	1.31	0.00	0.76	0.47	0.00
45-64	1.51	1.24	0.00	4.20	2.75	0.00
65-74	3.57	2.18	0.00	15.28	6.82	0.00
≥75	11.65	5.13	0.00	43.29	15.07	0.00
Propensity to hospitalisation						
low (ref.)	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 (Ref)	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-V. 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

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

Variables	Pneumonia			Diabetes		
	Crude RR	Adjusted RR	p - value	Crude RR	Adjusted RR	p - value
Sex and Age						
Males 17-44 (reference)	1	1		1	1	
45-64	2.35	1.64	0.00	4.28	2.54	0.00
65-74	8.14	3.34	0.00	8.88	3.24	0.00
≥75	24.65	9.73	0.00	10.92	3.82	0.00
Females 17-44	0.67	0.46	0.00	0.67	0.44	0.00
45-64	1.26	0.93	0.23	3.11	1.96	0.00
65-74	3.74	1.93	0.00	8.47	3.71	0.00
≥75	13.12	4.68	0.00	11.92	4.38	0.00
Propensity to hospitalisation						
low (reference)	1	1		1	1	
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	1		1	1	
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	1		1	1	
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

Chapter 5

Preventable hospitalisation and the role of primary care: a comparison between Italy and Germany

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Abstract

Aim The aim of the study is to compare the hospital admissions for ambulatory care sensitive conditions (ACSCs) in Italy and Germany and to discuss possible relationship with the different models of primary care supply.

Subjects and methods Information on hospital discharges from 2001 to 2008 in Italy and from 2000 to 2008 in Germany were used. A descriptive analysis of hospitalisation rates (HR) for ACSCs and a correlation analysis with contextual factors (availability of General Practitioners, number of hospital beds and Gross Domestic Product (GDP) per person) were provided. The HR for ACSCs was analyzed using a Poisson regression model. Potential effects of contextual risk factors were also analyzed using a multilevel mixed effects Poisson regression model.

Results In Italy avoidable admissions accounted for 8% of total admissions, in Germany 11 %. In Italy HR for avoidable acute conditions were stable in the study period, while that for chronic conditions decreased by 23%. In Germany the HR for ACSCs increased, both for acute and dramatically for chronic conditions. We found a clear pattern of higher HR for chronic ACSCs in Southern regions in Italy and in Eastern States in Germany.

Conclusions Geographic distribution of HRs for chronic ACSCs was related to GDP per person both in Italy and in Germany. In Italy policies aimed at reducing the recourse to hospitalisation seem to be successful. GPs, who are gatekeepers in Italy, may have played a role in shifting health assistance from in-patient care to out-patient care. Findings for Germany suggest a suboptimal use of hospital facilities and perhaps an underuse of either primary care and/or ambulatory specialist care.

Keywords: preventable hospitalisation, ambulatory care sensitive conditions, health care system, primary care, multilevel model

Introduction

Hospitalisation 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. Such a set of medical conditions is known as ambulatory care sensitive conditions (ACSCs) and includes pathologies such as asthma, diabetes, gastroenteritis, appendicitis or hypertension (Millman 1993). For Italy we found in a regional analysis that the type and density of primary care facilities and the provision of specialist visits, among other factors, influence admission rates for ACSCs (Rosano 2011a). However, results from Italy may not be valid for other countries. Therefore we tried to repeat our model, developed to explain regional differences in ACSCs in Italy, for Germany, a country with sufficient similarities and differences in the organisation of its health care system to be suitable for this comparative test.

Similarities and Differences between the Italian and German health care systems

Italy adopted (in 1978) a so called Beveridge health care model, Germany was the cradle of the so called Bismarck model. Both countries dispose of appropriate hospital statistics and have a federal health care system. Italy has been trying to reduce the costs of the hospital sector since many years, while in Germany this policy has a more recent history. The position of primary care and ambulatory specialist care varies considerably among both countries as well as the hospital organisation.

In Italy outpatients are mainly treated by general practitioners (GPs) and specialists in ambulatory settings. Ambulatory health care is provided by public sector (hospital and district health care units) and private for-profit providers. Health professionals can be chosen by patients through the regional health system, upon referral by a GP. In general it is very simple to request a specialist visit to GPs. Patients have free choice of GP, who are gatekeepers. GPs and ambulatory physician have contracts with the Regional Health regulated by agreement among associations of physicians and Regional and National Health authorities. Patient satisfaction with GPs is generally high (CENSIS 2010). Hospital care is universally provided in kind, without copayments. Patients is given the choice of opting for private, contracted-out hospitals that are required to be accredited by the regional government. The number of hospital beds is decreasing since 2000, a drastic reduction was apparent from 2005, mainly in favour of an increased number of beds in day hospitals. The number of beds per 1,000 persons in hospitals is 5.9, decreased by 40% from 1998 (HOPE, 2011). The 2010-2012 national plan for health states the target number of hospital beds per 1,000 is 4.0 with an occupancy rate of 85%.

In Germany GPs have no formal gatekeeper function. Private physicians, over half of which are specialists, are paid on a fee-for-service basis. Representatives of the sickness funds negotiate with the regional associations of physicians to determine aggregate payments. Patients have free choice of physicians. They may also choose other health professionals, however access to reimbursed care is available only upon referral by a physician. In Germany, with few exceptions, ambulatory care is strictly separated from hospital care. German hospitals use to treat inpatient care; sectoral borders to ambulatory are strict. While acute hospitals in the hospital plan provide outpatient emergency care, only university hospitals have formal outpatient facilities. More recently, since 2004, increasingly, hospitals are also providing ambulatory care which is regulated by a State Committee for Ambulatory Care. Physicians who work in hospitals are full-time salaried specialists, whose work is entirely devoted to in-patients. Family practitioners (about half of ambulatory physicians) are not gatekeepers. A large number of specialists compete with generalists to provide

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primary care (that is directly accessible) within the domain of their specialty (Orthopedics, Ear, Nose and Throat specialists and Dermatologists are notorious examples). On the other hand there are informal gatekeeping arrangements, specialists that accept patients only on a referral basis (e.g. most internal medicine sub-specialties). Around 5% of all office-based physicians have the right to treat patients inside the hospital (mainly the case for small surgical specialties). All other physicians transfer their patients to hospital physicians for inpatient treatment and receive them back after discharge. Individuals with insurance coverage (98% of resident population) have free choice of ambulatory care physicians and, if referred to inpatient care, of hospitals. In 2008 Germany had the highest level of hospital beds per 100,000 inhabitants in the EU (800), that decreased by 14% from 1998 (HOPE 2011).

In Germany hospital utilization, measured through the number of hospital discharges per 1,000 people, is among the highest of OECD countries (201) as well as the average length of stay (8.7 day); in Italy the number of hospital discharges per 1,000 people is 141, well below the average of OECD countries (161), the average length of stay is 6.8 day, higher than the OECD average (5.6) (OECD 2009). Other indicators of health care resources are provided in Table 1. The provider payment method of hospitals is based on DRG in both countries.

What is known about the explanation of differences in ACSCs?

Several factors have been demonstrated to influence the relationship between avoidable hospitalisation and primary care supply, such as the number of hospital beds, the epidemiology of conditions as well as socio-economic conditions in the population. In particular, socio-economic status has been showed to be associated with preventable hospitalisations both if measured at individual level (Blustein 1998) and at contextual level (Saxena 2006; Pirani 2006). Measures of deprivation are associated with increased admission rates. Although hospital admission for ACSC is potentially avoidable and rates of hospital admission for these conditions are possible indicators of the quality of care, they should be interpreted in conjunction with measures of socio-economic status. The number of GPs per 1,000 residents and the mean number of patients per GP have been reported as direct measures of access and continuity of primary (Kringos 2010). The objective of the study is to compare hospital admissions for ambulatory care sensitive conditions, in Italy and Germany, and to discuss a possible relationship with the different model of primary care supply.

Methods

ACSC definition

ACSCs are generally defined as conditions where appropriate ambulatory care may prevent or reduce the need for hospitalisation (Purdy 2009). The criteria adopted to select the ACS conditions were those defined by Pirani (2006) who adapted the original criteria defined by Weissman (1992) to the European context, selecting conditions with a higher prevalence, distinguishing those detectable in adult and paediatric populations and selecting a detailed list of ICD9 codes with exclusion criteria. The analyzed 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. Details on definitions and coding have been published by the authors in a previous study (Rosano 2011a).

Data source

Information on hospital discharges in Italy was extracted from the Hospital Discharge Register of the Ministry of Health in anonymous format. German data on hospital discharges were drawn from the Hospital statistics of the Federal Statistical Office (2012). In this study we used the total number of acute adult (over 18 years) discharges and ACSC discharges, selected on the basis of the ICD9-CM code of the main diagnosis. We extracted patient information regarding age, gender and region of residence. Data on the number of GPs per 1,000 residents, the number of patients per GP and the number of acute hospital beds per 1,000 residents were derived from the Health Informative System of the Ministry of Health in Italy and from the Federal Medical Registry in Germany. Data on Gross Domestic Product per person were drawn for both countries from the Eurostat statistics for territorial units (EUROSTAT – NUTS). The year of reference for both information was 2007. Population characteristics for Italy were obtained from the statistics of the resident population supplied by the Institute of National Statistics (ISTAT). Population characteristics for Germany were derived from the Eurostat database for population statistics (<http://epp.eurostat.ec.europa.eu/>).

Statistical analysis

The hospitalisation rate for ACS conditions was 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 the rate for ACSC was expressed as the number of hospitalisations per 10,000 resident population. We calculated 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, asthma, and COPD).

We performed a descriptive analysis of hospitalisation rates (HR) for ACSC from 2001 to 2008 (Italy) and 2000, 2002, 2004, 2006, 2008 (Germany), according to their availability, by region and type of ACSC. We calculated HR adjusted by sex and age, year of admission and region of residence and type of ACSCs.

Firstly, we analyzed the relationship between the regional HR by type of ACSC and the quantitative measures of primary care services, specifically the number of GPs per 1,000 persons and the number of patients per GP, the number of beds per 1,000 persons, and the regional GDP per person, using non-parametric correlation indexes. This was done in order to select the significant contextual factors to be used in the final model.

We then analyzed the rates of hospitalisation for ACS acute and chronic conditions respectively, by year of admissions, adjusted for some selected individual risk factors (patient's age, sex and region of residence), using a Poisson regression model. We calculated the Incidence Rate Ratios (IRR) with regions with lower values as reference: Piedmont region for Italy and Baden-Württemberg for Germany.

Finally, we also considered the potential effect of contextual risk factors, selected because having a significant correlation with HR, among those indicated in the literature as having a potential influence: the number of GPs per 1,000 residents, the number of patients per GP, the Gross Domestic Product (GDP) per person and the number of beds per 1,000 persons. For this purpose we used a multilevel mixed effects Poisson regression models (Leyland 2001), applying Stata's `xtmepoisson` option with a random intercept without any random coefficients (StataCorp 2009).

Results

In Italy the number of avoidable admissions ranged from 620 thousand in 2001 to 550 thousand in 2008 accounting for about 8% of total admissions. In Germany the number of avoidable admissions ranged from 1,7 million in 2000 to 2,1 million in 2008, accounting for about 11% of total admissions. In the same period the number of GPs per 1,000 persons was stable in Germany and decreased in Italy.

In Italy HRs for acute conditions were stable in the analyzed period, while those for chronic conditions decreased from 97.7 per 10,000 in 2001 to 77.1 in 2008. In Germany the HRs for acute conditions increased from 29.8 per 10,000 in 2000 to 40.2 in 2008. The increase for chronic conditions was dramatic: from 73.0 per 10,000 in 2000 to 126.6 in 2008 (Graph 1).

The number of hospital admissions for asthma in Italy was 19 per 100,000 adults, that for the chronic obstructive pulmonary disease (COPD) was 126 per 100,000 adults, for diabetes 33 per 100,000 (data not shown). In Germany about 11% of the admissions for ACSCs are attributable to diabetes. The number of hospital admissions for diabetes increased from 232 per 100,000 in 2000 to 319 per 100,000 in 2008. During the studied period the HRs for diabetes decreased by 30% in Italy and increased by 11% in Germany (data not shown).

Geographic variations

The HR distributions put in evidence a high variability of rates among regions both in Italy and in Germany. Considering the average HR along the studied period, as for Italy the HR for acute conditions varied from 22.9 per 100,000 in Campania to 52.1 in Trentino-Alto Adige (Map 1); HR for chronic conditions ranged from 53.7 per 100,000 in Piedmont to 124.2 in Calabria (Map 2). As for Germany HR for acute conditions ranged from 28.7 in Baden-Württemberg to 43.4 in Saarland and 43.7 in Bremen (Map 3); HR for chronic conditions ranged from 76.6 per 100,000 in Baden-Württemberg to 136.6 in Mecklenburg-Vorpommern (Map 4).

In Germany the average number of GPs per 1,000 residents was 7.2, ranging from 8.2 in Berlin to 6.6 in Brandenburg. In Italy the average number of GP per 1,000 residents was 7.9. The regional number ranged from 8.9 in Lazio to 6.5 in Trentino-Alto Adige. GDP per person in Germany was € 29,516, ranging from € 20,666 in Mecklenburg-Vorpommern to € 48,939 in the state of Hamburg. In Italy the average GDP per person was € 26,017 ranging at regional level from € 16,546 in Calabria to € 33,906 in Lombardia.

Correlation analysis

When analysing the correlation between the regional ACSC-HRs and contextual factors, we found a significant negative association between GDP per person and standardised hospitalisation rates for ACS for chronic conditions both in Italy ($r=-0.63$) and in Germany ($r=-0.54$). We also found an inverse correlation among HRs for ACS acute conditions and the rate of GPs per 1,000 residents in Italy, ($r=-0.30$; $p=0.11$), although it is not statistically significant. The number of patients per GP was found positively correlated with ACSC-HR, even though not significantly. GDP per person and the number of GPs per 1,000 residents were then used as contextual factors in regression models, respectively for the analysis of chronic conditions and acute conditions.

Poisson regression model results

In Italy the analysis showed as Northern and Central regions have a higher risk of hospitalisation for acute conditions, while Southern regions showed comparative

higher HRs for chronic conditions. Females had lower risk both for acute and specially for chronic conditions. In the study period the decrease of HRs in Italy was more marked for chronic conditions, with an average annual decrease of 5%, rather than for acute conditions (-1%) (Table 2).

In Germany the analysis showed that Northern Western regions have a higher risk of hospitalisation for acute conditions, while eastern regions showed comparative higher HRs for chronic conditions. Females had lower risk for chronic conditions, but a higher risk for acute conditions. The increase of HRs in Germany was more marked for chronic conditions, with an average annual increase of 6%, rather than for acute conditions (+2.2%) (Table 3).

Poisson multilevel regression model results

Finally we compared the risk to be hospitalized for ACSCs in Italy and Germany using the multilevel Poisson regression model, considering individual factors, such as age and sex, and contextual factors, such as GDP per person and the number of GPs per 1,000 residents. Germany showed a risk as high as 40% (IRR=1.44, 95% C.I. 0.69-3.02) compared to Italy to hospitalize for avoidable causes, although not statistically significant (data not shown).

Looking at the multilevel adjusted IRR, we realized the strong effect of GDP per person for chronic conditions: in Italy the variability of the regional distribution of multilevel adjusted IRRs decreased in comparison with simply adjusted risks, with a drastic reduction in Sicily, Sardinia, Campania and Liguria. The effect of the number of GP per 1,000 residents in the risk distribution for acute conditions was less strong in the modification of IRRs, with an increase in heterogeneity among regions in Italy. The risk distribution was only slightly modified with a more drastic impact in Marche, Veneto and Friuli in Italy (Table 2).

In Germany the IRRs for chronic conditions, adjusted for the same contextual factor using the multilevel model, were averagely decreased by 6% compared with risks estimated with the simply adjusted regression model. A marked decrease in estimated IRR was observed - as expected - in less affluent region (Saarland and Saxony-Anhalt). As well as Italy the effect of the number of GPs per 1,000 residents in the risk distribution for acute conditions was less strong than chronic conditions. The risk distribution was only slightly affected by the multilevel adjustment with a more drastic impact in Saxony-Anhalt, Mecklenburg-Western Pomerania and Thüringia (Table 3).

Conclusion

Avoidable hospitalisation accounts in Italy for 8% of admissions and 11% in Germany. It is about 550,000 admissions per year in Italy and 1,1 million admissions per year in Germany. We found a clear pattern in the geographic distribution of HR for ACSCs. HRs adjusted for contextual socio-economic characteristics, showed that Southern regions in Italy and in Eastern regions in Germany have higher risk of avoidable hospitalisation for chronic diseases. Both areas not only have a lower GDP per person but also suffer from lower levels of health care facilities resources (Costa 2003; Razum 2008). For both countries the socio-economic conditions in deprived areas are still a serious policy challenge.

In Germany, Chronic Heart Failure (CHF), Chronic Obstructive Pulmonary Disease (COPD), and type 2 Diabetes Mellitus (DM) were among the 20 most frequent causes of hospital admission in 2008 (Statistisches Bundesamt - Federal Statistical Office). Chronic care in Germany is mainly delivered by small primary care practices: the practice team usually consists of one or two physicians (general practitioner or

general internist) and a small number of healthcare assistants (HCAs), who have few clinical tasks. This model has apparent limits. A new protocol for the development of a complex HCA-led care management intervention for chronically ill patients aimed at implementing strategies to reduce avoidable hospitalisations in German primary care has been recently proposed (Freund 2010) highlighting barriers and enablers of the implementation of the care intervention.

Family practitioners have a different role in the analyzed countries: they are gatekeepers in Italy and they are not in Germany. This may play a role in the attempt to shift health assistance from in-patient care to out-patient care. Primary care has a fundamental role in the health care system and it influences, directly or indirectly, the access to hospital for ACSCs.

The mean number of inhabitants cared for by one general practitioner (GP) provides at least a rough indication of the accessibility of health care in a region. The number of GPs per 1,000 is slightly lower in Eastern States than Western States in Germany. In particular Brandenburg (located in the East) is the federal state with the second lowest density of GPs in Germany. The number of GPs in Brandenburg decreased from 1,701 in 1996 to 1,522 in 2004 (Kassenärztliche Vereinigung Brandenburg 2006). Brandenburg, along with Mecklenburg-Western Pomerania, has the highest rates of hospitalisation for avoidable chronic conditions. In Italy the number of GPs per 1,000 residents did not vary much, in North-Eastern regions we found the lower presence of GPs (6.5 per 1,000 in Trentino, 6.9 in Lombardia and 7.5 in Veneto), in Central and Southern regions the rate is a little bit higher (8.9 per 1,000 in Lazio, 8.7 in Umbria, 8.6 in Sicily and Basilicata). This is not correlated with the affluence of the regions, but a significant inverse relationship has been found with the rate of acute ACSCs. Hence hospitalisation for acute conditions, that can be more easily prevented with early diagnosis and treatment, is less frequent when the number of available GPs is higher.

German physicians are notable in international comparison because of the very high number of patient contacts per week and the short time for each patient contact. Because the proportion of primary care providers in private practice is less than 50%, it must be expected that a not inconsiderable share of primary care is provided by specialists in Germany (O'Connor 1991).

In Italy the major reform in 1999 introduced significant changes in primary health care services by reinforcing group practice, introducing economic incentives for GPs and promoting integration between primary care physicians and district services such as social care, home care, health education and environmental health. In particular, the law allows GPs to work in a team in several ways (European Observatory on Health Systems and Policies 2009). The reform could have played a role in improving the health care of chronic patients thus reducing avoidable hospitalisations for chronic conditions.

Looking at specific ACSCs, such as asthma, COPD and diabetes, we can observe that HRs in Italy are lower than the average of OECD countries. HR for asthma was indeed much lower than the average of OECD countries (19 vs. 52 per 100,000), that for the COPD and diabetes was about 40% lower than OECD average. Avoidable hospital admissions for asthma are lower in Germany than in other OECD countries. However, hospital admission rates for hypertension and congestive heart failure are higher in Germany than the OECD average (OECD 2011).

In Italy policies aimed at reducing the recourse to hospitalisation seem to be successful. Starting from the nineties different national and regional laws aimed at reducing the number of hospital beds and discouraging inappropriate hospitalisation because of budget cuts. Hospital rates declined steadily in the studied period (Rosano 2011b).

Countries adopting a national health service, with central or federal authorities, like Italy, have more possibilities to intervene in the health care provisions using laws, recommendation or even budget cut. This role is limited in countries, e.g. in Germany, where health care assistance is based on an insurance model.

The costs of National Health Service (NHS) systems are persistently lower compared to social security healthcare (SSH) systems over time both in terms of health expenditure per capita and as percentage of GDP. The population in SSH systems is more positive about its health care system than in NHS systems. There is apparently a trade-off between cost containment (and gate keeping) and user satisfaction (Van der Zee 2007).

Over the past three decades, all health systems of the EU countries have been affected by a series of reforms which have changed the organisational, financing systems, access policies. Organisational and managerial responses are very heterogeneous among EU countries. The supply of health services and use of health care resources have in fact a divergence in the experiences of different countries, partly due to cultural differences that tend to perpetuate itself in a perspective of path dependency (change in a society depends quantitatively and/or qualitatively on its own past) (Wilsford 1994). Against this backdrop, there is the need to develop analytical tools that are capable of grasping the complexity of these processes of transformation. A comparative framework is capable of exploiting the specific national situation, but at the same time to recognize the processes of convergence or divergence between the States (Genova 2010). The comparison between Italy and Germany in the field of avoidable hospitalisation constitutes a valuable opportunity to compare the European experience, becoming a tool for building European unity through the open method of coordination. A further strength of the study is represented by the used analytical approach: through a multilevel model a simultaneous examination of the effect of contextual factors (number of GPs, GDP per person) and individual level predictors (age, sex) has been allowed.

Limitations

The limitations of the study rest on the fact that administrative data were used for epidemiologic purposes. In addition, HRs may be influenced by many factors, such as epidemiology of diseases, provision of hospital beds, health care model, socio-economic status. We have not been able to adjust HRs for epidemiologic measures of the considered conditions. This may affect the findings such as the discussed higher HR for chronic conditions in Italian Southern regions, which are known to have higher prevalence of some of the selected conditions, such as diabetes and hypertension (Istituto Superiore di Sanità 2012). The provision of primary health care has been measured through the number of GPs per 1,000 residents and the number of patients per GP. These are (too) crude indicators as many other factors may influence the use of primary health care such as the individual health stock, the income, the family structure (Jimenez-Martin 2004) and actual differences in task profiles of GPs, all data not available in administrative datasets.

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Graph 1. ACSCs admissions rates per 100,000 by type among adult population. Year 2000-2008.

Comparison between Italy and Germany

Table 1. Health data in Italy, Germany and OECD countries. Year 2009

Country	<i>N of hospital discharges per 1,000</i>	<i>Average length of stay</i>	<i>N of GPs per 1,000 residents</i>	<i>N of acute care hospital beds per 1,000</i>
Italy	141	6.8	7.2	3.2
Germany	201	8.7	7.9	5.5
OECD	161	5.6		4.9

Source: OECD Health data 2009

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Table 2. Adjusted Incidence Rate Ratio (Adj IRR) and multilevel (ML) adjusted IRR of hospitalisation for ACSCs with 95% confidence interval inferior (inf) and superior (sup) limits, by Region, Age, Sex and Year. Acute and Chronic conditions, Italy.

	Acute conditions				Chronic conditions			
Variables	Adj IRR	ML IRR	Inf	Sup	Adj IRR	ML IRR	Inf	Sup
Sex								
<i>Males (reference)</i>		1.000				1.000		
<i>Females</i>	0.750	0.942	0.864	1.028	0.620	0.622	0.621	0.623
Age	1.310	1.241	1.230	1.253	1.510	1.514	1.513	1.515
Year (time trend)		0.984	0.983	0.985		0.952	0.952	0.952
Region								
Piedmont		1.000				1.000		
Valle D'Aosta	1.072	1.099	0.846	1.429	0.793	1.262	1.229	1.296
Lombardy	1.162	1.142	0.882	1.478	1.190	1.504	1.495	1.512
Trentino Alto Adige	1.320	1.383	1.375	1.695	1.327	1.678	1.662	1.694
Veneto	1.345	1.209	0.934	1.566	1.218	1.538	1.529	1.547
Friuli-Venezia Giulia	1.552	1.304	1.007	1.689	1.347	1.698	1.684	1.712
Liguria	0.982	1.088	0.840	1.409	1.055	1.328	1.318	1.339
Emilia-Romagna	1.307	1.244	0.961	1.611	1.235	1.557	1.547	1.566
Tuscany	1.102	1.033	0.798	1.338	1.075	1.355	1.347	1.364
Umbria	1.118	1.092	0.843	1.415	1.115	1.407	1.393	1.421
Brands	1.328	1.170	0.904	1.516	1.284	1.619	1.607	1.632
Lazio	1.039	1.014	0.783	1.313	1.275	1.614	1.604	1.624
Abruzzo	1.241	1.254	0.968	1.624	1.501	1.895	1.880	1.910
Molise	1.340	1.266	0.977	1.641	1.745	2.198	2.171	2.226
Campania	0.796	0.768	0.593	0.994	1.497	1.892	1.881	1.903
Puglia	1.208	1.150	0.888	1.489	1.816	2.294	2.281	2.308
Basilicata	0.981	0.904	0.697	1.171	1.386	1.748	1.729	1.768
Calabria	0.936	0.933	0.720	1.208	1.829	2.308	2.293	2.324
Sicily	0.959	0.942	0.727	1.219	1.631	2.058	2.046	2.070
Sardinia	1.328	1.319	1.019	1.709	1.322	1.670	1.657	1.684

Comparison between Italy and Germany

Table 3. Adjusted Incidence Rate Ratio (IRR) and multilevel (ML) adjusted IRR of hospitalisation for ACSCs with 95% confidence interval inferior (inf) and superior (sup) limits, by Region Age, Sex and Year. Acute and Chronic conditions, Germany.

	Acute Conditions				Chronic conditions			
Variables	Adj IRR	ML IRR	Inf	Sup	Adj IRR	ML IRR	Inf	Sup
Sex								
<i>Males (reference)</i>		1.000				1.000		
<i>Females</i>	1.673	1.162	1.157	1.166	0.777	0.752	0.750	0.753
Age	1.266	1.294	1.294	1.295	1.511	1.496	1.496	1.497
Year (time trend)	1.022	1.026	1.026	1.027	1.060	1.060	1.060	1.060
Region								
Baden-Württemberg (reference)		1.000				1.000		
Bavaria	1.211	1.225	1.216	1.234	1.323	1.283	1.277	1.289
Berlin	1.312	1.353	1.340	1.367	1.182	1.278	1.270	1.287
Brandenburg	1.389	1.276	1.262	1.291	1.608	1.596	1.586	1.607
Bremen	1.579	1.525	1.497	1.553	1.541	1.300	1.284	1.316
Hamburg	1.195	1.272	1.255	1.289	1.143	1.141	1.132	1.151
Hesse	1.161	1.133	1.123	1.143	1.253	1.219	1.213	1.226
Mecklenburg-Western Pomerania	1.433	1.312	1.295	1.330	1.922	1.804	1.791	1.818
Lower Saxony	1.224	1.222	1.213	1.232	1.292	1.223	1.217	1.229
North Rhine-Westphalia	1.384	1.345	1.336	1.354	1.641	1.495	1.489	1.501
Rhineland-Palatinate	1.358	1.322	1.309	1.334	1.473	1.365	1.357	1.373
Saarland	1.590	1.476	1.453	1.498	1.808	1.564	1.550	1.578
Saxony	1.123	1.042	1.032	1.052	1.392	1.310	1.302	1.317
Saxony-Anhalt	1.330	1.203	1.189	1.216	1.821	1.609	1.598	1.619
Schleswig-Holstein	1.127	1.104	1.091	1.117	1.193	1.068	1.061	1.076
Thuringia	1.242	1.131	1.118	1.145	1.746	1.637	1.626	1.648

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Map 1. Average rates of ACSC among adult population along the years 2001-2008 by region. Acute Conditions. Italy. Rates per 100,000

Comparison between Italy and Germany

Map 2. Average rates of ACSC among adult population along the years 2001-2008 by region. Chronic Conditions. Italy. Rates per 100,000

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Map 3. Average rates of ACSC among adult population along the years 2000-2008 by region. Acute Conditions. Germany. Rates per 100,000

Comparison between Italy and Germany

Map 4. Average rates of ACSC among adult population along the years 2000-2008 by region. Chronic Conditions. Germany. Rates per 100,000

Chapter 6

Avoidable Hospitalisation and the role of GPs: a multilevel approach

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Abstract

Background. Avoidable hospitalization (AH) has been widely adopted as an outcome measure of the accessibility and effectiveness of primary care. However, most of the relevant studies were conducted at high aggregation levels (countries, regions), while the mechanisms were supposed to operate at lower levels (GP-level).

Objective. To explore the relationships between AH and a specific set of indicators related to general practitioners' (GP) activities in the Lazio Region (Italy).

Methods. A retrospective cohort study has been conducted using data on GP activity and publicly-provided health services collected for the year 2008. The analysis was performed using a multilevel Poisson regression model.

Results. The study included data from 4,837 GPs active in the Lazio Region and their 4,666,037 assisted patients. The AH rate of assisted patients was 77.3 per 10,000. Such a HR was negatively associated with the number of prescribed diagnostic services and positively associated with the number of prescribed DDD per patient. Patients followed by GPs working in team practice showed a reduced risk of hospitalization for avoidable conditions.

Conclusion. Much of the existing evidence on AH is based on aggregated data. Using detailed person-level data it has been possible to analyze AH rates in relation to specific health services provided by GPs. The study showed as the role of GPs in preventing AH is crucial, particularly whether they work in team practice. The study is a further piece of evidence in favor of the validity of AH as outcome measure of quality and accessibility of primary care.

Keywords: primary health care, avoidable hospitalization, diagnostic procedures, GPs prescriptions, team practice, Italian health care system

Introduction

Avoidable hospitalisation (AH) - also termed as hospitalisation for ‘ambulatory care sensitive conditions (ACSC), or “ambulatory sensitive hospitalisations” or “preventable hospitalisations”- can be considered as hospitalisation potentially preventable by timely and effective provision of primary care. It is unlikely that any subject suffering from an ACSC can avoid hospitalisation. There is in fact a structural gap between Primary Care (PC) and acute care, and only a not defined proportion of hospitalisation can be avoided through an efficacious PC assistance. However, the extent to which the hospitalisations for ACSCs are avoided, say the rate of AH, is an indicator originally developed in the USA ^{1,2} and then widely adopted by international health systems as outcome measure of the accessibility and overall effectiveness of primary care.^{3,4}

Fundamentally the idea is that the capacity of GPs to provide an early diagnosis (and treatment when possible) of acute conditions or its precursor and the good ongoing control and management of chronic conditions may play a role in preventing AH.⁵ Such a capacity can be measured through specific indicators in the context of continuity of care, comprehensiveness, quality and efficiency of PC,⁶ such as the number of patients per GP and the number and type of drugs and diagnostic services prescriptions per patient.

AH is particularly attractive as outcome measure of health system performance because it can be generated from routine hospital data and yet focus attention on the outcomes of care, rather than the process. However, a number of key questions about the validity and value of this measure remains unanswered. Much of the research relating to AH has focused on socioeconomic, race-related and urban-rural differentials, which may reflect gradients in health status (disease prevalence and severity) as well as in access to or quality of healthcare, using an ecological design of the study.

Findings from previous studies

Two recent systematic reviews on the issue supported the hypothesis that more PHC resources are associated with less hospitalisation for ACSC, still after adjusting for patients’ health status.^{7,8} However, while the first review – by Rosano - substantially affirmed the validity of AH as outcome measure of quality and accessibility of PC, the latter – by Gibson - concluded that “the relationship between PHC resourcing and diabetes-related ACSC must still be considered inconclusive”.

In Spain a significant variation of AH rates were found among health districts,⁹ linked to the hospital accessibility in geographic terms rather than to organizational features of primary care.¹⁰ It has been also shown that partnership organization of GPs was associated with lower risks of AH.¹¹

In a previous study ¹² conducted at regional level we found that the number of diagnostic services prescribed by the GPs were higher in regions with lower rates of AH rates. An Australian study showed more presentations to EDs owing to the closing of GP services on weekend.¹³ Other factors that have been demonstrated to influence the relationship between AH and primary care supply are, e.g., the number of hospital beds, the epidemiology of conditions – linked both to hospitalisation and use of primary care services ⁸ - as well as the socio-economic status of the

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population.¹⁴ These factors were tested in the Italian context,¹¹ using ecological methods, namely data aggregated at regional level.

The majority of previous studies have one (neglected) element in common: they are conducted at high aggregation levels (regions or communities) while mechanisms are supposed to operate at e.g. primary care provider level (prescription behaviour of GPs).

Individual characteristics must be considered when studying area characteristics and avoidable hospitalisation.¹⁵ The use of individual data and taking account of the different area levels that may influence outcomes means that we will avoid the risk of the ecological fallacy, a common bias in ecological studies.¹⁶

Aim of study

The aim of this study is to explore the relationships between frequency, nature of primary care services and the hospital admissions for ACSCs, considering factors that may confound and mediate these relationships. Specific objectives are: to establish the relationships between use of primary care services - such as diagnostic prescriptions, drug prescriptions, daytime accessibility to GPs' consultation - and rates of AH (separately for chronic and acute conditions); to test the contributions of person-level, geographic-level and service-level factors to these relationships; to consider these findings in order to drive change. The use of analytical data would provide more robust evidence to the hypothesized relationships.

Methods

Setting

Lazio is a region of central Italy (including Rome) with a population of 5,342,587 in 2008. The health administration of the of the Lazio region is composed by 12 Local Health Units (LHUs), 5 in the city of Rome, and 55 Health Districts (HDs), 20 in the city of Rome. As well as all the other Italian regions, a universal coverage for health is provided to all residents. Details of the Italian Health Care System are presented in Box 1.

Study design and participants

We conducted a retrospective cohort study on 4,837 GPs out of 4,897 active in 2008 in the Latium region and their 4,666,037 assisted patients aged 18 years and older.

Data sources

Information on GPs, such as their identification code, the health district where they are located, the adherence to forms of team practice and the number of assisted patients were collected from the Regional health administrative database of the GPs. The completeness and validity of the administrative database is checked periodically by the LHUs. Such a database does not contain information on health status and health service accesses of patients, that can be derived through a record linkage procedure with the Regional Health Information Systems (HIS), where the identification code of caring GP is reported for each patient.

The regional HIS include complete and reliable information on services provided by public and contracted providers, namely: discharges from all public and private sector hospitals; ED presentations, ambulatory services; drug prescriptions (coded using the ATC code system); hospital beds.

Data concerning the deprivation index were drawn from the Census 2001.¹⁸

Data linkage

A relational database resource has been created by linking anonymized data from administrative archives concerning the GPs activity and publicly-provided health services, including hospital admissions, ED visits, diagnostic services and drugs prescriptions. Each patient record was associated with his/her treating GP. Data linkage has been performed by the Agency of Public Health (ASP). The linkage was performed according to national and regional rules on health data use. Data were linked through deterministic linkage, using as linkage key an encrypted version of the GPs identification code. The linked data will include all records available in the 2008 for each dataset. GPs with no registered activity were excluded from the study.

Data selection and definitions

Outcome measure was the hospitalisation for ACSCs of patients aged 18 or more years. ACSCs were grouped in two different lists of conditions according to the different prevention strategy: the first include conditions that are supposed to be prevented through early diagnoses (and treatment) of the condition or its precursor; the latter through good ongoing control and management.^{8,19} The list of the conditions, adapted to the Italian context from the list proposed by Caminal¹⁹, with the ICD9 codes used to identify them is reported in Table 1. For specific analyses it has been considered the hospitalisation for single conditions, such as asthma, heart failure, diabetes and COPD. Some contextual factors were also collected and used for the multilevel analysis: a deprivation index, calculated at HD level, and the number of acute hospital beds per 1,000 residents, calculated at LHU level.

Quality of GP care – the exposure factor - was measured through the following indicators obtainable from routine data of the regional HIS: the number of defined daily dose (DDD) of all prescribed pharmaceuticals qualified for subsidy per patient, the number and type of prescribed diagnostic services per patient and the number of Emergency Department (ED) accesses – considering only the lowest level of the triage codes (white codes), the adherence to “team practice” groups. All data refer to the year 2008.

A group of experts of the Agency of Public Health selected diagnostic services which are specific for diagnosis or monitoring some conditions: glycated hemoglobin (HbA1c) and diabetes; IgE allergy screening / spirometry and asthma²⁰; spirometry and COPD²¹; echocardiogram and HF.²²

Deprivation index

From the data collected from the 2001 General Census of Population and Housing five variables that operationally combine to represent the multidimensionality of the social and material deprivation concept have been selected: low level of education, unemployment, non-home ownership, one parent family and overcrowding. Data

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were collected at census track⁵ level, and then aggregate by HD. The index is calculated by summing standardized indicators.²³

Statistical analysis

Main outcome of the study was the rate of hospitalisation for ACSCs by treating GPs' patients (number of hospital admissions over number of GPs' treated patients). The unit of analysis is the GP. The analysis was performed using Poisson regression models, separately for acute and chronic conditions. Exposure variables were recoded in quartiles before the inclusion in the models, where 4th quartiles are compared to 1st quartiles.. Further models were used to analyse the relationship between specific ACSC and the provisions of related diagnostic ambulatory services: diabetes and glycated hemoglobin; asthma and allergy screening; COPD and spirometry; heart failure and echocardiogram. Data were analysed at different geographical levels: by region overall, by HD and by LHU. For each factor it has been calculated an Incidence Rate Ratio (IRR): values of IRR > 1 indicate an increased risk, values of IRR < 1 indicate a decreased risk of hospitalisation. The statistical significance of the results was set at the 5% level Further details on statistical methods are included in appendix 1.

Results

The study included data from 4,837 GPs active in the Lazio Region in 2008, with an average number of patients per GP of 829, from a low of 687 in the Rome A LHU to a high of 969 in the LHU of Viterbo. The number of hospital admissions for ACSCs among resident patients was 29,774.

Descriptive data analyses revealed that the hospitalisation rate (HR) for ACSCs, adjusted for age, was 77.3 per 10,000 overall, varying considerably among treating GPs: from 0 to 446 per 10,000. (Data not shown) HR for ACS chronic conditions do not vary considerably among the LHUs (about 2.3 per 1,000 residents), excluding the area of Rieti (3.1 per 1,000 residents) as well as for ACS acute conditions. The number of white codes (ED access with no health reason) can be interpreted as a potential missed assistance by the GP. This number is higher in the provinces of Latina (6 per 100 residents) and Rieti (7 per 100 residents), where the rates of chronic conditions are also higher. The number of diagnostic procedures is quite homogeneous among LHUs (from 58 to 75 per 100 residents), with a slightly higher average number in the LHU of the city of Rome (85 per 100 residents). The average number of prescribed defined daily dose (DDD) per 100 residents was 38, lower in the LHUs of the province of Rome (24 per 100 residents) and higher in the city of Rome (52 per 100 residents). (Table 2)

Patients followed by GPs working in team practice showed a lower risk to be hospitalized both for avoidable acute diseases (IRR= 0.93; 95 C.I.:0.87-0.98) and for chronic diseases (IRR= 0.97; 95 C.I.:0.94-1.00). Among chronic diseases the associated HR were significantly lower for heart failure (IRR= 0.91; 95 C.I.:0.87-0.96), and lower – but not significantly – for hypertension (IRR= 0.95; 95 C.I.:0.78-1.16), asthma (IRR= 0.95; 95 C.I.:0.69-1.29), diabetes (IRR= 0.96; 95 C.I.:0.88-1.05), COPD (IRR= 0.99; 95 C.I.:0.91-1.08). Team practice had an apparent effect also in

⁵ census tracts have an average number of inhabitants of 169 and average area of 0.6 square km

terms of reduction of the rate risk of inappropriate access to ED (access to EDs with white codes): IRR= 0.75; 95 C.I.:0.74-0.76.

The 3-step test procedure, described in appendix, confirmed the opportunity to use a multilevel model. The Likelihood Ratio test that compares the multilevel mixed-effects models (model iii and iv) vs. Poisson regression (model ii) was statistically significant, this justifies the use of a mixed-effects Poisson model. The median incidence rate ratio (MIRR) is interpreted in such a way that the mean increase in the rate of AH (overall) between any two district is 28% in the empty model; 24% in the II level model and 17% in the final model. This suggests certain variability between the rates by district. In the final multilevel model the HR for acute and chronic conditions were negatively associated with the number of prescribed diagnostic services, even though not significantly, and positively associated the number of DDD per patient. The association with prescribed diagnostic services was more marked for acute conditions, while the association with the number of DDD per patient was more apparent for chronic conditions. (Table 3) The risks of HR were linearly associated with quartiles of selected explanatory variables.(data not shown) The contextual factors played a significant role: the association with the deprivation index ranged from an IRR of 1.07 to 1.30, showing higher levels for chronic conditions; that with the number hospital beds ranged from an IRR of 1.03 to 1.06, with significant levels only for acute conditions.

Further analyses concerned the relationship between specific ACSCs and the provisions of related diagnostic ambulatory services, always adjusting for the deprivation calculated at district level and the number of hospital beds. The IRR related to the specific relationships were: diabetes and glycated hemoglobin (IRR = 0.92; 95% conf int. 0.89 - 0.95); asthma and allergy screening (IRR = 0.93; 95% conf int. 0.83 - 1.04); asthma and spirometry (IRR = 0.93; 95% conf int. 0.82 - 1.06); COPD and spirometry (IRR = 0.92; 95% conf int. 0.89 - 0.95); heart failure and echocardiogram (IRR = 0.97; 95% conf int. 0.96 - 0.99).

Discussion

Summary

The study showed as drugs and diagnostic services prescriptions by GPs are associated with patients' hospitalisation for ACSCs. The positive relationship between drug prescriptions and rates of AH is consistent with the – obvious - fact that sick people need drug therapies, especially in case of chronic diseases. The idea that appropriate drug therapy may prevent worse disorders, with consequent hospitalisation, is counterbalanced by the fact that persons with more severe conditions – or with multichronicity – need more drugs and have higher risks to be hospitalized. When we analysed diagnostic procedures related to specific conditions, e.g. diabetes, asthma, COPD and heart failures, we realized the real power of PC assistance to prevent AH. The risk of hospitalisation decrease from 3% to 8% in patients assisted by GPs who were more likely to prescribe specific diagnostic procedures in order to monitor their chronic diseases. This association was statistically significant when we analysed the prescription of glycated hemoglobin tests and the hospitalisation for diabetes, the prescription of spirometries and the hospitalisation for COPD, the prescription of echocardiograms and the hospitalisation for heart failure; not in other cases, likely because of the limited study power. Findings confirm the validity of AH as a measure of quality and accessibility of PC.

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The positive effect of the organization of GPs in collaborative groups was clearly shown, particularly when considering the association between AH and the access to ED with white codes that can be considered as “inappropriate access”. Team practice guarantees the availability of GPs for more hours per day and days per week. So, inappropriate accesses to ED - more frequent after hours or in the week – can be prevented thanks to the “filter function” of GPs in patients’ health care seeking. Deprivation – as contextual factor - plays a significant role. It is associated with higher risk of hospitalisation for ACSCs, specially for chronic conditions, independently with the role of GPs.

Although reductions in the risk of AH associated with the activity of GPs are not impressive in relative terms (3% to 8%) it must be considered that AH represents in Italy about 480,000 admissions per year,¹² for an approximate cost of 1,4 billion of euro. So, also a 5% of reduction means avoiding about 20,000 admissions.

Comparison with existing literature

Contrasting evidence exists on the effectiveness of team practice compared with solo practice on chronic disease management.²⁴ In a previous study conducted in six Italian regions, no impact - in terms of adherence to recommendations - was found for the management of diabetes and heart failure, while a slightly significant impact was observed for ischemic heart disease.²⁵ In our study, considering AH as outcome measure, the relationship between GPs acting in team was apparent, both for acute and chronic conditions – in particular for heart failure, with a 10% of reduced risk of hospitalisation.

Poor control of glycated hemoglobin in diabetic patients is a recognized risk factor for complications and higher hospitalisations. Chen²⁶ in a previous study found a correlation between socioeconomic factors and poorer control of serum glucose levels (high HbA1c scores) at inpatient admission. In our study patients whose GP prescribes less HbA1c tests showed higher hospitalisation risks, even after controlling for deprivation.

Glycated hemoglobin (HbA1c) test and echocardiography are considered indicative of the quality of care delivered at primary care level respectively for diabetes and heart failure. The project “VALORE” conducted in six regions by the Italian Agency for Regional Health Services (Agenas) did not find any advantage for GPs participating in associative forms compared with GPs who works individually in terms of adherence to national and international guidelines for the management of heart failure diabetes in primary care.²⁷ This may contradict our findings, however it must be said that the Agenas study measured the outcome from a GP perspective, while hospitalisation is measured from a patient perspective.

Data on access and quality of primary care, e.g. the number of prescriptions per physician, were considered in the study, but the risk for avoidable hospitalisation may be influenced not only by primary care but also by the vicinity to other forms of outpatient care, for example, hospital-based specialist care.²⁸

To study contextual determinants of health, considering the extent to which individual health phenomena cluster within areas, is not only necessary for obtaining correct estimates in regression analysis. It also provides relevant information that permits

assessment of the importance that the context has for different individual health outcomes. The higher rate of avoidable hospitalisation, specially for chronic conditions - in deprived health districts may be due to lack of appropriate local primary care services, but it may also be due to the composition of the population of the area, with higher disease prevalence. The prevalence of disease is higher in lower socioeconomic groups, but is not always directly translated into higher demand for healthcare services.²⁹ Although access and availability to primary care in theory is equitable, the quality of care and continuity of healthcare providers varies between primary care centres, as doctors may find it less attractive to work in disadvantaged areas.²⁸

Strength and limitations

A critical point concerns the registration of personal information in the HIS, which may have important implications on the procedures for record-linkage between archives. In many Italian regions there is a centralized computer system. At regional level the personal data of HIS are organized not uniformly, they are often incomplete and out of date. Lazio region disposes of large and complete dataset of health information services. Such data have been tested for consistency and can be considered highly reliable.³⁰

Much of the existing evidence on AH is based on aggregate analyses, thus potentially suffering from ecologic fallacy. Using detailed person-level data it has been possible to provide more reliable evidence on the relationship between AH rates and health services provided by GPs. For the first time we have been able to analyse the relationship between the GPs prescription of specific health tests (spirometry, glycated hemoglobin, echocardiogram) and the hospitalisation for related chronic diseases (COPD, Asthma, Diabetes, Heart Failure).

Using a multilevel approach we have been able to control for factors that potentially influence the relationship between quality and accessibility of primary care and AH at different geographic level, which correspond with different organizational levels.

Implications for research and/or practice

Team practice appears a key issue for the improvement of primary care performance in Italy. The new associative forms among GPs should be encouraged emphasizing the functional relationships between professionals, facilitating patients' access to services, proposing effective models of comprehensive care of those suffering from chronic disease. In other countries a mixed fee per item and capitation based remuneration system of GPs served as incentive to stimulate the provision of services by general practitioners, resulting in reduced referral rates.³¹

Quality indicators of PHC aimed at measuring the health status of patients and the appropriateness of the health services provided are essential. AH as outcome measure of the quality and accessibility of PC can provide useful information to manage PHC.

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The views expressed are those of the author(s) and not necessarily those of the Agency of Public Health or the Departments of Health of the University of the Sacred Heart of Rome or the University of Maastricht.

Box 1. The Italian Health Care System

Italy's health care system is a regionally-based national health service that provides universal coverage free of charge at the point of service with financing mainly based on taxation. The system is organized into three levels: national, regional and local. The national level is responsible for ensuring the general objectives and fundamental principles of the national health care system. Regional governments, through the regional health departments, are responsible for ensuring the delivery of a benefits package through a network of population-based health management organizations (Local Health Units - LHU). Local Health Units (LHU) provide care directly through their own facilities or through services supplied by Independent Hospital Trusts, Research hospitals and accredited private providers (acute and rehabilitation hospitals, diagnostic laboratories, nursing homes, outpatient specialists). Coordination of GPs activity is a responsibility of health districts (HD). HD are geographical subunits of LHUs responsible for coordinating and providing primary care, nonhospital-based specialist medicine and residential and semi-residential care to their assigned populations. All residents, upon request, are assigned to a GP, who provides, free of charge, primary care assistance and acts as gatekeeper for ambulatory services, hospital care and drug prescription. Since the late 1990 innovative forms of group primary care delivery has been developing in Italy. It is about of pool of GPs who decide to share structures, facilities and decide to collaborate in common projects.

Chapter 6

Table 1. List of Ambulatory care sensitive conditions: definitions, codes and exclusion

ACS conditions by group	ICD-9-CM codes	Exclusion
<i>Conditions preventable through early diagnosis and treatment</i>		
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	
<i>Treatable conditions through good ongoing, control and management</i>		
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	
B7: COPD	466.0, 490-2,, 494, 496	

Table 2. Number of assisted patients, Hospitalization rate (HR) for acute and chronic ACSCs per 1,000 persons, average number of: diagnostic procedures (DP) , defined daily dose (DDD), Emergency Department access with white codes (EDW) per 100 person by Local Health Unit (LHU).

LHU	N. of assisted patients	HR for chronic ACSC	HR for acute ACSC	Persons per GP	DP	EDW	DDD
Rome A (city)	423,659	1.93	4.65	687	77	3	52
Rome B (city)	570,002	2.01	4.37	831	92	3	27
Rome C (city)	474,479	1.94	4.25	764	87	3	30
Rome D (city)	472,722	1.78	4.34	844	84	2	26
Rome E (city)	426,391	2.66	5.38	794	85	2	28
Rome F (province)	236,651	2.27	5.74	900	74	2	24
Rome G (province)	377,612	1.99	5.93	902	68	2	23
Rome H (province)	427,338	2.66	5.29	876	75	3	25
Viterbo	254,568	2.81	5.14	969	66	2	23
Rieti	131,801	3.08	8.12	831	65	7	28
Latina	450,198	2.07	6.89	853	69	6	27
Frosinone	414,618	1.87	5.58	853	58	2	25
Lazio	4,660,037	2.26	5.47	829	77	3	38

Table 3. Measures of association (IRR) between GPs activity indicators and district characteristics and the rates of acute, chronic and overall conditions with inferior (inf) and superior (sup) limits of 95% confidence interval. Measures of variation and clustering (Median Incidence Rate Ratio – MIRR) obtained from the multilevel logistic models. Lazio Region, year 2008.

<i>Diagnostic procedures</i>	Acute conditions			Chronic conditions			Overall		
	IRR	Inf	Sup	IRR	Inf	Sup	IRR	Inf	Sup
Measures of association (IRR, 95% C.I.)									
N. of diagnostic procedures prescription (GP level)	0.95	0.87	1.02	0.99	0.94	1.04	0.97	0.93	1.02
Being part of team practice (GP level)	0.93	0.88	0.98	0.95	0.91	0.98	0.94	0.91	0.97
Deprivation (District level)	1.06	0.94	1.21	1.20	1.03	1.39	1.15	1.01	1.32
Number of hospital beds per 1,000 pop (LHU level)	1.05	1.02	1.09	1.03	0.99	1.07	1.04	1.00	1.07
Measures of variation or clustering									
MIRR (level II - district)	1.15			1.20			1.17		
MIRR (level III - LHU)	1.16			1.21			1.19		

Table 3 (follow)

ED access with white codes	Acute conditions			Chronic conditions			Overall		
	IRR	Inf	Sup	IRR	Inf	Sup	IRR	Inf	Sup
Measures of association (IRR, 95% C.I.)									
N. of ED access with white codes (GP level)	1.00	0.93	1.09	1.02	0.96	1.07	1.01	0.96	1.05
Being part of team practice (GP level)	0.93	0.88	0.98	0.95	0.91	0.98	0.94	0.91	0.97
Deprivation (District level)	1.06	0.93	1.20	1.20	1.03	1.39	1.15	1.01	1.31
Number of hospital beds per 1,000 pop (LHU level)	1.05	1.02	1.09	1.03	0.99	1.07	1.04	1.00	1.07
Measures of variation or clustering									
MIRR (level II - district)	1.15			1.20			1.17		
MIRR (level III - LHU)	1.16			1.21			1.19		

Drug prescription	Acute conditions			Chronic conditions			Overall		
	IRR	Inf	Sup	IRR	Inf	Sup	IRR	Inf	Sup
Measures of association (IRR, 95% C.I.)									
N. of DDD prescriptions (GP level)	1.31	1.07	1.20	1.49	1.09	1.17	1.45	1.39	1.52
Being part of team practice (GP level)	0.95	0.90	1.00	0.97	0.94	1.01	0.97	0.94	0.99
Deprivation (District level)	1.09	0.93	1.24	1.25	1.06	1.46	1.20	1.04	1.38
Number of hospital beds per 1,000 pop (LHU level)	1.06	1.02	1.10	1.04	1.00	1.08	1.04	1.00	1.08
Measures of variation or clustering									
MIRR (level II - district)	1.17			1.22			1.19		
MIRR (level III - LHU)	1.16			1.22			1.20		

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Appendix 1. Statistical methods: multilevel models

In order to consider geographic-level and service-level factors we used a multilevel approach analysis, using two different cluster levels: LHU and HD. The multilevel regression considers that the individual probability is also statistically dependent on the area of residence of the subjects. In the LHU as well as in the HD are supposed to play a differential influence both on the organization of primary care, that in the Lazio region is ruled at HD level, and on the provision of hospital care, in the Lazio region concentrated in some LHUs of Rome. Moreover, deprivation index calculated at HD level represents a validated socio-economic indicator, a potential confounding factor to be considered in the analysis of AH.¹

We first estimated an “empty” model (model i), which only includes a random intercept and allowed us to detect the existence of a possible contextual dimension for this phenomenon. Thereafter, we included the individual GPs characteristics in the model (model ii) to investigate the extent to which area levels differences were explained by the GP composition in the areas. Finally we added the variable collected at HD and LHU level (model iii and iv) to investigate whether this phenomenon was conditioned by specific area characteristics.² For this purpose we used a multilevel mixed effects Poisson regression models, applying Stata's `xtnepoisson` option with a random intercept without any random coefficients.³

The model is given by: $\log(E(Y_{ij}|\zeta_{1j})) = \beta_1 + \beta_2 x_{2ij} + \dots + \zeta_{1i} + \zeta_{1k}$, $\zeta_{1i} \sim N(0, \tau_2)$, $\zeta_{1k} \sim N(0, \tau_3)$ with: GP identifier (i); District identifier (j); LHU identifier (k); Number of hospital admissions (y_{ij}); quartiles of the number of prescriptions of diagnostic procedures or quartiles of the number of ED accesses or quartiles of the number of prescribed DDD drugs (x_{2ij}); dummy identifying the participation (1) or not (0) in team practice (x_{3ij}); dummy variable for the z-score of the deprivation index - 1 for deprived districts 0 for not deprived districts - (x_{4ij}); rate of hospital beds in the LHA (x_{5ik}). Explanatory variables were recoded in quartiles before the inclusion in the models, where 4th quartiles are compared to 1st quartiles. Through multilevel models a simultaneous examination of the effect of contextual factors (deprivation index, number of hospital beds) and individual level predictors has been allowed.

It is important to separate the different levels in order to understand how much of the differences observed in AH rates is due to GPs' performance, what are the factors describing the differences among GPs' physician (eg. being part of team practice) and what are due to district level factors (deprivation) or LHA level (number of acute hospital beds). The traditional statistical models, such as the regression linear, are not adequate for the study of data multilevel because the effects at various hierarchical levels are not separated and, consequently, parameter estimation is not accurate.

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Chapter 7

Main findings and conclusion

Chapter 7

In this thesis we investigated the concept and the use of AH as an outcome measure of quality and accessibility of primary care (PC). Primary healthcare is a cornerstone of healthcare systems in the 21st century. It is fundamental to have valid, reliable and easily calculable measures in order to monitor the performance of PC. AH has been proposed as an outcome indicator of PC access (Institute of Medicine, 1993). The rationale underlying the concept of AH is that timely and effective care, delivered in a primary care setting, can reduce the risk of hospitalisation for certain conditions (Weissman, 1991; Billings et al, 1993; Institute of Medicine 1993). Differences between populations at risk are linked to the failure to obtain PC at an earlier stage of the medical problem. As such, the rate of AH has become an important indicator of the functioning of a health care system. The concept of better access is linked to the supply of GPs, where individuals living in areas with reduced supply may experience difficulty in accessing GPs, compared to those living in areas with higher GP supply. This can be evidenced by longer waiting times for appointments, longer travel times to obtain care, shorter physician consultations, and reduced follow-up (Laditka, 2005). The majority of the studies conducted in the USA concluded that improving access to PC is likely to reduce AH rates. However it should be noted that such findings were found in the specific USA setting, where there is no universal provision of health care; as such, findings are not necessarily comparable to other situations. Worldwide, there are conflicting results in the few studies that have directly examined the relationship between physician supply and avoidable hospitalisations (Clancy, 2005; Laditka, 2005; Ansari, 2006).

Earlier studies (Blustein, 1998) reported that poorer, sicker and less-educated populations were more prone to hospitalisation for ACSC. The question is whether the relationship between socio-economic status and avoidable hospitalisations simply reflects socio-economic gradients in patient health status and not in healthcare (Giuffrida, 1999). Similarly, hospital admission rates in the UK tend to reflect socioeconomic differences and patient morbidity, rather than quality in PC (Giuffrida, 1999; Reid, 1999). Alternative hypotheses in relation to the differing findings regarding avoidable hospitalisation analyses suggest that the aspects of PC which are most effective in assisting individuals with chronic and acute conditions frequently associated with hospitalisations to manage their care have not yet been identified, in particular for those in lower socio-economic groups (Clancy, 2005). Open questions are hence the relationship between physician supply and AH and the role of socio-economic status in the analysis of such relationships.

In our study we analysed the validity of AH as an outcome measure of PC, pointing out the importance of considering socio-economic status as a possible confounding factor. The idea is that the capacity of GPs to provide an early diagnosis (and treatment when possible) of acute conditions or their precursors and the ongoing control and management of chronic conditions may play a role in preventing AH (Rosano, 2011).

Through the geographical and temporal analysis of AH we have also been able to investigate the variability of AH in time and space, illustrating the relationship with peculiar area characteristics as well as with the impact of changes over time in health

policies or health budget cuts. The analysis was conducted in the Italian context, but we also compared results with Germany, a country with both similarities and differences in the organisation of the HCS and, for this reason, suitable for a comparative test about the role of PC.

Finally, using individual data, we considered the role of socio-economic factors and the adherence of GPs to team practice, which has been found to reduce the risk of AH (Rosano, 2013a), when analysing the relationship between specific activities of GPs with regard to ACSH as a whole and with single conditions.

The rates of total hospitalisation (TH) may provide information about epidemiology of diseases, access to hospital care, and appropriateness of hospital use. AH has been used as outcome measure of quality and access to PC. Analysing the relationship between trends in TH and AH improves our understanding of trends in access to hospital care over time in relation to the role of various explicative factors, such as the cutting of health resources, the accessibility and quality of PC, the organisation and the provision of the different settings of care in the territory. This was another aspect investigated in this thesis.

Research questions

1. What is the relationship between AH and measures of accessibility to PC in the international Health Services research literature?

We conducted a systematic literature review – presented in Chapter 2 – which allowed the identification of key factors influencing the relationship between AH and PC in different HCSs. To measure quality and accessibility of PC, four types of indicators were mentioned in the reviewed literature: the number of GPs per 1,000 residents and the presence of community health centres (or number of primary healthcare centres in the living areas), both calculated at group level; the number of GP or specialist visits, and access to an enhanced primary healthcare programmes, calculated at individual level. The majority of the selected studies were conducted in the USA (38); the others were conducted in Spain (4), Canada (2), Brazil (2), the UK (2) and one each in Australia, Italy and New Zealand.

Most studies confirmed the postulated inverse association between indicators of accessibility and primary healthcare quality and hospitalisation for ACSC (say better performance of PC is associated with lower AH rates). More than three-fourths of the studies were conducted in the USA where this evidence is more apparent. From the few selected studies conducted in other countries the evidence was less clear.

GPs act as ‘gatekeepers’ in Australia, Brazil (for tertiary care), Italy, New Zealand, Spain, and the UK but not in the USA and Canada. No positive association between AH and indicators of accessibility of primary healthcare centres was found in countries where GPs act as ‘gatekeepers’. One possible explanation is that ‘gatekeepers’ may promote appropriate ambulatory care and filter elective hospital care.

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Socio-economic conditions are recognised risk factors for AH and were considered in many studies. Patients who have better schooling levels present lower chances of hospital admission due to avoidable causes (Culler, 1998). Through our systematic review we have been able to confirm the validity of AH as a outcome measure of accessibility and quality of primary healthcare also among vulnerable groups, with over 70% of the studies finding the expected inverse relationship between them. In the USA, middle and lower income classes are: less likely to receive preventive services; more likely to experience delays in their care; and less likely to have a regular source of care (Institute of Medicine, 1993), increasing the need for hospitalisation. In countries that adopted the Beveridge system (a tax-financed HCS) deprivation has a limited impact in accessing PC, especially among children (Casanova & Starfield, 1995).

We can conclude that the majority of studies confirmed the expected inverse relationship between indicators of primary healthcare accessibility and hospitalisation for ACSC. The adjustment for socio-economic status appears to be a fundamental aspect and has always to be considered.

2. Does the trend of AH deviate from the general hospitalisation trend in Italy?

In Italy, as well as in many European countries, hospitalisation rates steadily decreased over the last 20 years. We explored the trend in rates of hospitalisation for ACSC in Italian regions and we tried to test whether the trend is attributable to the general trend of reduction in hospital use rather than changes in primary healthcare delivery.

In the study presented in Chapter 3 we calculated and compared the age-standardised rates per 1,000 persons of general hospitalisation and avoidable hospitalisations in the period 2001–2008 in Italy. Avoidable admission rates did not decrease to deeper levels than the general hospital admission rates in the studied period. Regarding AH we observed that acute avoidable conditions and chronic conditions showed different patterns: slightly increasing in the first case; decreasing, even if not at a statistically significantly level, in the latter. In order to understand the trends better we used a particular regression analysis, named JoinPoint regression, in order to assess the existence of points of change in the slope of the rates of AH, as well as general hospitalisation. We found a change in slope of the rates of AH, but not for general hospitalisation. The change happened in 2005 and can be interpreted in conjunction with the increase of admissions for day hospital care observed until 2005 and the drastic drop afterward, due to policies adopted to limit the hospital admissions for overnight stay. In fact the majority of patients had been admitted in day hospitals for conditions and procedures (e.g. diagnosis of chronic diseases) that often coincide with ACSC. The decline in the rates of AH for chronic conditions may be interpreted in a positive light, suggesting that access to effective PC has been improving. Comparing the rates of total hospitalisation and those attributable to ACSC, we found the latter to be more sensitive to changes in PC policy.

The overall decline in hospitalisation rates implies that the costs in the acute care sector have been reduced. The decline of hospital admissions is likely due to budget cuts and consequently a reduction in hospital beds. However, the state of health of the Italian population does not seem to be affected. In a system where the access to healthcare is more balanced, with patients receiving care in the appropriate setting, more resources can be placed in other sectors, such as preventive care and medical research.

3. What are the factors influencing the relationship between PC care provision and avoidable hospitalisation and how do they manifest themselves differently across geographic areas in Italy?

In any given geographic area, the expectation is that the rates of avoidable hospitalisations will be lower when people are receiving the PC they require. Conversely, in areas where access to medical care is more limited, rates of AH tend to be higher (Cloutier-Fisher, 2006). In the study presented in Chapter 4 we examined variability among the Italian regions in the rates of AH, taking into account the influence of epidemiological factors, health care delivery patterns as well as patients' characteristics, such as age and sex.

PC plays a different role in the prevention of hospitalisation 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. We analysed acute and chronic conditions separately finding distinct geographical patterns and different relationships with the explanatory factors: hospitalisation for acute ACSC showed higher values in the regions of the North among the elderly and women in reproductive age; hospitalisation for chronic conditions showed lower rates in the regions of the North and higher rates in the regions of the South, particularly among women. When we analysed the correlation between the hospitalisation for ACSC and the provision of ambulatory specialist and especially diagnostic services in the Italian regions we found a significant inverse relationship with the rates of chronic ACSC.

In Italy the central government defines the minimal national benefits package that must be offered to all residents; the regions have the responsibility for the organisation and delivery of health services. As such, the organisation of healthcare, as well as the epidemiology of chronic diseases, vary among regions. The analysis of the variability among the Italian regions of hospital admissions for ACSC, and their relationship with the supply of PC is a useful tool to evaluate the effectiveness and/or appropriateness of PC services provided by the regions. In the study presented in Chapter 4 we considered a new organisation of PC delivery – the team practice – that has been growing in recent years, especially in central regions such as Toscana, Umbria, Marche, Liguria, Emilia Romagna and Veneto (Cicchetti, 2008). Since the late 1990s innovative forms of group PC delivery has been developing in Italy, where previously GPs used to work alone. These are pools of GPs who decide to share structures and facilities and collaborate on common projects. GPs work in teams in three forms:

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- i) *Medicina in associazione* (base group): between three and ten GPs working in their own offices but sharing clinical experience, adopting guidelines and organising workshops for quality and appropriate prescribing assessment;
- ii) *Medicina in rete* (network group): same characteristics as the previous type; in addition, GPs share a common patient electronic health record system;
- iii) *Medicina di gruppo* (group practice): three to eight GPs share both the same office and the patient electronic health record system.

We analysed the correlation between the proportion of GPs working in team (any form) and the time series of hospitalisation rates (total, avoidable acute conditions, chronic avoidable conditions) and we observed a significant correlation, both with avoidable acute conditions and with avoidable chronic conditions. This may be attributed to the possible benefits that team practice guarantees, that can be summarised in: continuity of care; availability of GP for more hours per day and days per week; adherence to guidelines and innovative projects.

4. What are the differences in the role of PC in countries with different HCSs: the case of Italy and Germany

Comparisons among countries with different HCSs may be helpful to better understand the role of PC in relationship with AH in different contexts as well as to understand the relevance of hospitalisation for ACSC to assess the accessibility and quality of PC. Italy (in 1978) adopted a tax-financed HCS (so-called Beveridge system); Germany was the cradle of the so-called Bismarck model, which is an insurance-based system. Both countries provide appropriate hospital statistics and have federally organized HCSs. Italy has been trying to reduce the costs of the hospital sector for many years, while in Germany this policy has a more recent history. The position of PC and ambulatory specialist care varies considerably between the two countries as well as hospital organisations. The most important difference in their primary healthcare systems concerns the role of GPs: they are 'gatekeepers' in the Italian system, while they are not in Germany. Both countries have, practically, universal health coverage: in Italy through a NHS funded by taxation; in Germany through different health insurance schemes (public or private).

In the study reported in Chapter 5, we found a clear pattern in the geographic distribution of hospitalisation rates (HR) for ACSC. HRs, even after controlling for contextual socio-economic characteristics, showed that Southern regions in Italy and in Eastern regions in Germany have higher risk of avoidable hospitalisation for chronic diseases. Both areas not only have a lower GDP per capita but also suffer from lower levels of healthcare facility resources (Costa, 2003; Razum, 2008). For both countries the socio-economic conditions in deprived areas are still a serious policy challenge.

Germany showed as much as 40% higher rates compared to Italy to hospitalise for avoidable causes, although this is, strictly speaking, not statistically significant. The

findings supports the hypothesis of better performance of the Italian primary healthcare system. Italy, with its state-regulated healthcare system, can relatively easily implement government reforms in the health sector. In Germany the policy implementation depends more on the cooperation of insurers and providers than on direct governmental decisions (Van der Zee, 2007). Moreover, very high-income countries, like Germany, can afford to base their HCS more on hospital care, which is more resource-consuming, than on PC (World Health Organization, 2008).

5. What is the role of GPs in AH in the Latium region?

In order to validate AH as a measure of the primary healthcare performance we used the individual data from the Health Informative System of Latium Region exploring the relationships between hospital admissions for ambulatory care sensitive conditions and a specific set of indicators related to GPs' activities. The selected indicators were: the adherence to 'medicine in association' groups (team practices), the number of GP prescribed defined daily doses (DDDs) per patient, the number and type of GP prescribed diagnostic services per patient and the number of Emergency Department (ED) accesses.

Much of the existing evidence on AH is based on analyses of aggregated data (e.g. regional data). The use of analytical data (say individual data) provides more robust evidence to the hypothesised relationships. The study presented in Chapter 6 showed that more diagnostic service prescriptions by GPs were associated with lower patient hospitalisation for ACSC, while more drug prescriptions were associated with higher avoidable hospitalisation. Findings confirm the validity of AH as a measure of quality and accessibility of PC (Rosano, 2013b). Also organizational element, such as team practise, has been shown to play a role in reducing the risk of AH.

This final study of the thesis made use of the findings of previous studies included in this project. The study analysed separately chronic and acute conditions, considered the socio-economic factor and the extent of the availability of hospital beds – included as contextual variables in the multilevel regression analysis – and the GPs' adherence to 'team practice', which has been found to be associated with lower rates of AH. By using individual data it was possible to explore specific activities of GPs in relationship to both the group of conditions included in the ACSC list and with single causes of hospitalisation. We found significant inverse associations between hospitalisation for diabetes and GP prescriptions for glycated haemoglobin; hospitalisation for chronic obstructive pulmonary disease (COPD) and GP prescriptions for spirometry; hospitalisation for heart failure and GP prescriptions for echocardiogram. All the associations provide evidence of the capacity of specific GPs' activities to reduce the risk of hospitalisation. Such findings confirm – at analytic level – the results reported – at aggregate level - in chapter 4: the potentiality of diagnostic services provided at PC level to reduce the risk of AH. Finally, the relationship between quality and accessibility of PC and AH through multilevel models was examined, which allowed for control of factors that potentially influence

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such a relationship at different geographic levels, which in Italy – i.e. in a federal system – correspond with different organisational levels

Methodological reflections

One of the main aims of the thesis was to try to validate AH as an outcome measure of accessibility and quality of primary healthcare. The validity of a measurement method is the extent to which it measures what it is supposed to measure. The validity of AH has been tested using correlation tests and association tests between avoidable hospitalisation rates and recognised measures of accessibility and quality of primary healthcare (Kringos, 2010). AH has been investigated in American studies for over 20 years, while its use in other countries has a more recent history. The validity of AH in different countries, with different HCSs, cannot be taken for granted. In Chapter 2 we faced the problem of validity of AH through a systematic review.

When studying AH, possible confounding or contextual factors have to be considered. Socio-economic factors as well as the availability of primary healthcare and hospital supply are recognised factors that may influence the relationship between AH and primary healthcare access. These concern factors that are usually available at an area level, or only make sense if referred to in a geographical context (e.g. the number of hospital beds). Multilevel regression analysis provides an appropriate study approach. The multilevel regression considers that individual probabilities are also statistically dependent on the area of residence of the subjects. In our studies we used multilevel models to analyse the effect of contextual factors (e.g. the number of GPs per 1,000 persons, GDP per capita) and individual level predictors (e.g. age, sex) simultaneously. This approach was used in the analyses conducted in Chapters 5 and 6.

In Chapter 3 and 4 we deepened the study in the Italian context. We analysed the distribution of rates of AH over time and space. The geographical analysis was conducted on regional data using standardised measures followed by mapping of the results. The time trends were analysed using a JoinPoint regression analysis. This method is useful to assess changes in a time series. The procedure, also known as piecewise or segmented regression, fits a model based on the minimum number of JoinPoints (points of change in slope) that are observable across a series of rates over time. Thanks to this approach we found a breaking point in the series of AH rates that could be interpreted in conjunction with changes in the hospital admission policy in the country.

In essence, we adopted a multidisciplinary approach investigating how social factors and organisational factors affect access to primary healthcare. According to a “health system research” approach we used two perspectives: the organisational level and the health care level (Delnoij, 2013). The organisation level made use of the information of the various organisations of PC in Italy, both analysing the different regions – which vary in organisational choices given the federal organisation of the Italian HCS – and considering the different organisations of GPs (associations,

medical networks, PC groups). The healthcare level was investigated through a comparison between Italy and Germany, two countries with similarities in health conditions of the population and differences in the HCS. The international comparison allowed considering organisational structure, methods of financing care, planning and regulation of the systems and the policies to improve health. From the comparison between Italy and Germany we were able to argue that Italy, with its NHS, is more prone to respond to changes in the healthcare organisation and to reach a better performance of primary healthcare. Methodological challenges were: the selection of appropriate measures, which allowed comparability and offered the possibility to aggregate data in order to create indicators; the identification of data sources; and agreeing on concepts and definitions. With a systematic review we were able to clarify the concept of AH and its use in the scientific literature. The availability of complete and reliable Health Information Systems in the studied countries allowed the use of a substantial number of measures and indicators both in the hospital setting and in the PC setting.

Research recommendations

Comparing the relationship between AH and quality and accessibility of PC between different countries may help to better understand the role of PC in countries with different HCSs and/or the choice about the organisation of the different levels of healthcare. Such studies can be useful to assess the integration among the different levels of healthcare, as well as the quality, appropriateness and accessibility of services in a supranational perspective. Over the past three decades, all healthcare systems of the European Union (EU) countries have been affected by a series of reforms which have changed the organisational and financing systems and access policies. Organisational and managerial responses are very heterogeneous among EU countries. The supply of health services and use of healthcare resources diverge in terms of the experiences of different countries, partly due to cultural differences that tend to perpetuate in a perspective of path dependency: change in a society depends quantitatively and/or qualitatively on its own past (Wilsford, 1994). Against this backdrop, there is the need to develop analytical tools that are capable of grasping the complexity of these processes of transformation. A comparative framework is capable of exploiting the specific national situation, but at the same time recognising the processes of convergence or divergence between the States (Genova, 2010). An example of a comparative study is the project QUALICOPC (Quality and Costs in Primary Care in Europe), aimed at showing which configurations of primary healthcare are associated with better outcomes, in terms of quality and equity (van Loenen, 2013). The comparison between Italy and Germany in the field of AH, presented in Chapter 5, constitutes a valuable opportunity to compare European experiences, becoming a tool for building European unity through the open method of coordination. Further and wider comparison projects would be necessary to investigate the quality of primary healthcare from normative and epidemiological points of view.

Another field of research to be investigated is the relationship between outpatient care – overall – and AH. In this thesis we have mainly considered the role of GPs;

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however, other providers of outpatient care, such as medical specialists, may play a role in the prevention of AH. This can be investigated when reliable and continuous data are available; that is the case of countries with advanced Health Information Systems.

Finally, we showed that specific GP activities (diagnostic service prescriptions, drug prescriptions) may influence hospitalisation for patients' ACSC. It would be interesting to investigate other aspects, such as guideline adherence, in relation to specific ACSC. It is a challenge to reveal the deeper mechanisms between these concrete GP-activities and Avoidable Hospitalisation, especially in the case of high prescribing rates.

Limitations

Limitations of the studies presented in the thesis rest on the fact that administrative data were used for research purposes. Some factors, e.g. the prevalence of specific conditions and the propensity to hospitalisation, were measured at a regional level. Thus, a possible ecologic fallacy may affect results. However, data on the prevalence of each condition were not available for all pathologies studied, limiting the specific analysis to few conditions, such as diabetes and pneumonia.

We were able to use indicators of PC to provide an estimate of the extent of primary healthcare service provision, but not to evaluate their quality in all aspects, such as screening or vaccination coverage (Kringos, 2010). Factors which may be independently associated with the risk of hospitalisation regardless of PC provision, such as comorbidities, were not considered. Further limitations may derive from coding procedure of diagnoses, which may vary over the years. This may cause some bias in the interpretation of findings.

Other settings of outpatient care provision, that is, other than PC, were not considered. This was due to the difficulty to obtain comparable measures of outpatient specialist care among countries, also because the type of HCS and its effectiveness may heavily influence the relationship between the provision of outpatient care and hospitalisation. The analysis of this type of relationship, not associated with the accessibility and quality of PC, was out of the scope of this study. However, day care, ambulatory specialist care and other forms of outpatient care may influence the extent of the rate of AH, especially for chronic conditions. This should be considered, in particular in countries where GPs are not 'gatekeepers' and consequently have a limited role in regulating the access of patients to outpatient care.

The provision of primary healthcare has been measured through the number of GPs per 1,000 residents and the number of patients per GP. These are (too) crude indicators as many other factors may influence the use of primary healthcare such as the individual health stock, income, the family structure (Jimenez-Martin, 2004) and actual differences in task profiles of GPs, data not available in administrative datasets that were used.

Strength

The study of AH was developed through a multidisciplinary approach, using epidemiological, clinical and socio-economic models. Comparing different regional and national contexts we were able to better understand the variability of AH rates and to test the validity of AH as an outcome measure of PC accessibility and quality.

The strength of the thesis also lies in the fact that we were able to analyse the risk of avoidable hospitalisations by using information at individual (GP) level, adjusted for patients' demographic risk factors whilst simultaneously considering contextual factors, measured at a regional level, such as the propensity to hospitalisation and the prevalence of specific conditions.

In the studies presented in Chapters 5 and 6, we used multilevel models that allowed the study of contextual determinants of health, considering the extent to which individual health phenomena cluster within areas. This is not only necessary for obtaining correct estimates in regression analysis, it also provides relevant information that permits assessment of the importance that the context has for different individual health outcomes.

Implications for public health policy and health services

Causes of avoidable admissions arise at four levels of healthcare – prevention, Primary Care, other ambulatory care, and hospital care. Preventive measures reduce the risk of contracting disease. If the condition does occur, successful management at the level of PC stops it from escalating to the point where specialistic ambulatory care is required. In turn, successful management at this level stops acute admission to hospital care. Following discharge from hospital, appropriate management at the ambulatory and PC levels decreases the likelihood of re-admission. To manage avoidable hospital admissions effectively, all these intervention points must be addressed (Miller, 2003).

The evidence from the studies collected in this thesis confirmed the validity of AH as an outcome measure of accessibility and quality of PC. AH may be an outcome of either poor or good quality of care depending on the complex causes that led to it. Interventions aimed at reducing hospitalisations for ACSC should target actionable causes at the system, practice, community, and patient levels (Freund, 2013). The strategies to reduce AH are multifaceted, all implying the adoption or the enhancement of public health policies. The main issues are continuity of care, failure to use ambulatory care services, help-seeking behaviour, non-compliance to treatment, fragmentation of health services, budget cuts and increases in chronic diseases prevalence. In the following table we report a summary of possible implications for public health policy according to the main findings of the thesis.

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Main findings	Possible implications for public health policy (by level of care)			
	Primary care	Ambulatory care	Hospital care	General policy
i) <i>We identified some causes of hospitalisations for ACSC – such as chronic diseases – which are more strongly associated with indicators of primary care performance than others, therefore more sensitive to policy aimed at improving access and quality of PC.</i>	Enhance the continuity of care for chronic disease in primary care.			
ii) <i>Failure to use ambulatory care services is another actionable target for reducing hospitalisations for ACSC and may indicate poor quality of care.</i>		Access to existing specialised ambulatory care services may need to be improved, even in countries with low barriers to secondary care (as in Germany).		

Main findings and conclusions

Main findings	Possible implications for public health policy (by level of care)			
	Primary care	Ambulatory care	Hospital care	General policy
iii) <i>We found that DDDs are associated with an increased risk of AH.⁶</i>	Intervention to improve the compliance to drugs treatment should be patient-focused.			
iv) <i>The higher rate of AH in Italian southern regions, particularly for chronic conditions, may be attributed to lack of coordination and integration of care, which is a recognised issue in the Italian debate on the HCS.⁷</i>				Close coordination needs to be ensured between PC, home care, social care, and specialist care. Moving towards people-centred services, strengthening and adequately supporting primary healthcare as a link to other levels of care.

⁶ Lack of compliance to treatment is a known risk factor for hospitalisation (Chin et al., 1997). The need for more drugs is undoubtedly associated with multi-chronicity. Because medication adherence is negatively associated with increasing numbers of prescriptions, however, interventions targeting medication adherence face barriers in patients with multiple chronic conditions and prescriptions. Intervention to improve the compliance to drugs treatment should be patient-focused, such as using compliance-enhancing packaging or using drugs with reduced dose frequency, rather than physician focused (Atreja et al., 2005). It should be also considered that prescribing behaviour can be affected by economic incentives (Scott & Farrar, 2003), and by the organisational and institutional features of the system under which physicians (associations, medical networks, PC groups, presence of a specialist centre in the area) operate (Westert & Groenewegen, 1999).

⁷ The supply of health services is often fragmented, while the health problems that patients present require co-operation between different providers and integration of care in pathways. Close coordination needs to be ensured between primary care, home care, social care, and specialist care, with defined care pathways, shared record systems and other changes to support more integrated processes. (WHO, 2008) Moving towards people-centred services, strengthening and adequately supporting primary health care as a hub to other levels of care, here are effective interventions for strengthening the delivery of health services to improve access to high-quality, people-centred and evidence informed care.

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Main findings	Possible implications for public health policy (by level of care)			
	Primary care	Ambulatory care	Hospital care	General policy
v) <i>We estimated that in Italy in 2005 the hospitalisation for ACSC accounted for about 480,000 admissions, for an approximate cost of EUR 1.4 billion.⁸</i>			Policies aimed at providing alternatives to acute hospital admission have the greatest long-term benefit in reducing the percentage capacity at which the acute sector is working. A greater proportion of service delivery could, and should, occur in primary and community settings.	
vi) <i>We found that changes in time trends of hospitalisation rates for ACSC are more sensitive to changes in PC policy.</i>				Interventions in primary care should be the first choice.

⁸ Budget cuts create huge pressure on service providers to exploit efficiency reserves. Health care provided at acute hospitals are the most expensive part of the health and social care system for a range of chronic conditions, which indicates poor value for money and has led to unacceptably long waiting times for elective health services. The unsustainable nature, concerning current and planned resources, of current service models is apparent. Policies aimed at providing alternatives to acute hospital admission have the greatest long-term benefit in reducing the percentage capacity at which the acute sector is working. A greater proportion of service delivery could, and should, occur in primary and community settings (Starfield, 1994) The number of hospital beds required and the costs of the acute care sector depend critically on the ability of services in the community to reduce the need for acute interventions.

Main findings and conclusions

Main findings	Possible implications for public health policy (by level of care)			
	Primary care	Ambulatory care	Hospital care	General policy
vii) <i>The Italian primary healthcare system, with its state-regulated HCS, can relatively easily implement government reforms in the health sector and has been able to reduce the burden of AH more than Germany, where policy implementation depends more on the cooperation of insurers and providers than on direct governmental decisions.</i>				The fundamental issues of a health service should be ruled centrally at state/federal level.
viii) <i>The adherence of GPs to 'team practice' groups, has been found to be associated with lower risks of AH.</i>	Professionals should no longer work alone, but with teams, i.e. along with their peers or with other professionals.			

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A new model of PC in Italy

The new organisational model of PC recently proposed provides for GPs to share their expertise, to have a more effective and efficient management of chronic diseases and to improve in the ability to take charge of the patients.

According to the law 189 dated November 8th 2012 promoted by the Minister of Health Renato Balduzzi, Italian PC will have two organisational forms: Territorial Functional Aggregations [Aggregazioni Funzionali Territoriali (AFT)] and Complex Primary Care Units [Unità Complesse di Cure Primarie (UCCP)]. In this organisational structure, professionals no longer work alone, but in teams, along with their peers (named AFT) or with other professionals (named UCCP). The national information system and the rest of the network of regional services are ways to ensure care for entire days, seven days a week, reducing the need for health services to engage the second and third levels, increasing the overall efficiency of the NHS.

Concluding remarks

Primary healthcare is a key vehicle for addressing the challenges faced by health systems. According to the Health 2020 agenda a primary healthcare approach is a cornerstone of health systems in the 21st century. The need to find and validate easy-to-calculate measures of the performance of PC is thus fundamental.

AH is an important issue to focus on. The broader context of effective chronic disease prevention and management in PC to reduce AH could be considered a medium-term area of focus. Health policies should be focused on target populations, not specific conditions/diseases in isolation. Key populations of interest identified are deprived subjects, the frail elderly and those with multiple comorbidities (Baker, 2011).

Ambulatory care sensitive hospitalisations are a useful performance measure of primary healthcare, and of clear interest to policy makers. Such a measure is based on hospital administrative data, which are objective, available and relatively inexpensive to gather. Improvements in the scope and reliability of primary healthcare data collection will improve the accuracy and interpretability of the results of studies on the issue.

Access to PC is associated with a reduced rate of hospitalisation for ACSC. Previous studies' findings had been considered inconclusive, and the relationship between primary healthcare resourcing and hospitalisation for ACSC remained uncertain (Gibson, 2013). This thesis provided better evidence on the relationship between access to PC and rates of AH supporting the validity of AH as outcome measure of PC access and quality.

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Summary

Primary Care (PC) can be defined as generalist and ambulatory care being the first level of access to professional health care provision. PC is characterised by its accessibility for the population, irrespective of the nature of health problems, and is provided near the patients' homes. Besides providing curative care, PC also offers preventive care and health education. In many European countries, GPs or family physicians are the main providers of PC.

Avoidable hospital admissions are seen as an outcome measure of access and quality of PC. Despite a large amount of research in this area, there is still little clarity about the definition of the conditions for which hospitalisation can be considered avoidable and about the factors related to this phenomenon. This thesis aimed to gain insight into the concept of AH and the role PC plays and can play in reducing this phenomenon.

The major focus of this thesis was on: i) the factors influencing the relationship between PC provision and avoidable hospitalisation (AH); ii) the variability of the AH rates across geographic areas and over time in Italy; iii) the differences in the role of PC in two countries with different Health Care Systems (HCSs), the case of Italy and Germany; iv) the relationship between specific activities of GPs and AH rates.

In Chapter 1 we dealt with the conceptualisation of the problem and we posed the research problems and questions. The concept of AH came up in the USA's healthcare system in the 1970s. AH was generally intended as hospitalization for ambulatory care sensitive conditions (ACSC), that is a set of conditions for which the role of PC is crucial in preventing the recourse to hospital care, namely: acute conditions such as disorders of hydro-electrolyte metabolism, pneumonia, bleeding of perforating ulcers, appendicitis with complications, urinary tract infections, and pelvic inflammatory disease; chronic conditions such as diabetes, amputation of lower limbs in patients with diabetes, hypertension, angina pectoris, heart failure, asthma, and chronic obstructive pulmonary disease. AH is part of the prevention quality indicators designed by the Agency for Healthcare Research and Quality to measure hospitalisations that could have been prevented with appropriate community-based care. These measures enjoy wide support and have been adopted for use in several states in the USA. In order to transfer these findings to the Italian healthcare system we planned a set of empirical studies that form the core of this thesis.

In Chapter 2 we conducted a systematic literature review on the issues which allowed the identification of key factors influencing the relationship between AH and PC in different HCSs by answering the research question about the relationship between AH and measures of accessibility to PC, both over time and among different HCSs.

To measure the quality and accessibility of PC four types of indicators were the most frequently mentioned in the scientific literature: the number of GPs per 1,000 residents; presence of community health centres or number of primary healthcare

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centres in living areas; the number of GP or specialist visits; and the availability of enhanced primary healthcare programs. Socio-economic conditions are a recognised risk factor for AH, they were considered in many studies. Patients who have better schooling levels present lower chances of hospital admission due to avoidable causes.

Along with socio-economic conditions there are other contextual factors which may influence the relationship between the performance of PC and AH, such as the epidemiology of diseases, and the availability of acute hospital beds. These factors were evaluated in Chapters 5, and 6 at different area levels, using appropriate statistical models.

Primary care plays a different role in the prevention of hospitalisation for chronic and acute conditions. Acute conditions are supposed to be prevented through early diagnoses (and treatment) of the condition or its precursor; chronic conditions through good ongoing control and management. For this reason acute and chronic conditions had to be analysed separately.

In Chapter 3, we analysed the distribution of the rates of AH over time. In Italy, hospitalisation rates have steadily decreased over the last 20 years. Therefore, it is also likely that a decrease in hospitalisation due to ACSC will be observed. Here, we tried to answer the research question about the possible deviation of trends from the rates of AH in respect to general hospitalisation rates. We explored the trend in Italian regions over the years 2001 to 2008 and found that avoidable admission rates did not decrease more than the general hospital admission rate in the studied period. Looking at AH we observed that acute avoidable conditions and chronic conditions showed different patterns: slightly increasing in acute conditions; decreasing, even if not statistically significantly, in chronic conditions. However we found hospitalisation for ACSC to be more sensitive to changes in PC policy, such as the changes in the organisation of PC delivery due to the introduction of innovative forms of team practice among GPs, starting in the late 1990s and becoming increasingly common.

In any given geographic area, the expectation is that the rates of avoidable hospitalisations will be lower when people are receiving the PC they require. Conversely, in areas where access to medical care is more limited, rates of avoidable hospitalisations tend to be higher. In Chapter 4 we answered the research question about factors influencing the relationship between PC provision and AH and their variability among the Italian regions. The analyses were conducted separately for chronic and acute conditions and gender, considering as possible explanatory factors the propensity to hospitalisation, and the epidemiology of the selected conditions. In Italy AH accounts for 8% of total hospitalisation, out of which 35.7% for acute ACSC; 64.3% for chronic ACSC. We found distinct geographical patterns and relationships with the following explanatory factors: hospitalisation for acute ACSC showed higher rates in the regions of the north among the elderly and women in reproductive age; hospitalisation for chronic conditions showed lower rates in the regions of the north and higher rates in the regions of the south, particularly among women.

In Chapter 5 we dealt with the differences in the role of PC between countries with different HCSs, analysing the case of Italy and Germany. Italy and Germany are countries with both similarities and differences in the organisation of HCSs; for this reason they were suitable for a comparative test about the role of PC. Comparisons among countries with different HCSs may be helpful to better understand the role of PC in relation to AH in countries adopting different models of PC, and to understand the relevance of hospitalisation for ACSCs to assess the influence of PC accessibility and quality. We have compared the geographic distribution of the rates of AH in the two countries in the years 2000 to 2008. We found a clear pattern in the geographic distribution of hospitalisation rates. The multilevel models adopted for the analyses, controlling for contextual socio-economic characteristics, showed that southern regions in Italy and in eastern regions in Germany have higher risk of AH for chronic diseases. Both areas not only have a lower GDP per capita but also suffer from lower levels of healthcare facility resources. For both countries the socio-economic conditions in deprived areas are still a serious policy challenge. Germany showed a risk as high as 40% compared to Italy to hospitalise for avoidable causes, although this was not found to be statistically significant. The findings support the hypothesis of a better performance of the Italian primary healthcare system.

The capacity of GPs to provide an early diagnosis (and treatment when possible) of acute conditions (or precursors) and the ongoing control and management of chronic conditions may play a role in preventing AH. Such capacities can be measured through specific indicators in the context of continuity of care, comprehensiveness, quality and efficiency of PC. In Chapter 6 we answered the research question about the role of GPs in AH through a study which made use of individual data from the Health Informative System of Latium region (Rome and surroundings) aiming at exploring the relationships between hospital admissions for ACSC and a specific set of indicators related to GP activities: the number of patients per GP, the adherence to team practice groups, the number of prescribed DDDs per patient, the number and type of prescribed diagnostic services per patient and the number of ED accesses. The positive effect of the organisation of GPs in collaborative groups (team practice) – in terms of reduction of AH - was clearly demonstrated, particularly when considering the association between AH and the access to ED with white codes (non-urgent patients) that can be considered as 'inappropriate' access. The study is a further piece of evidence in favour of the validity of AH as an outcome measure of quality and accessibility of PC.

Finally, in Chapter 7 the findings of all the studies are summarised and discussed, and some recommendations for research and (Italian) health policies are proposed. The main findings concerned: i) the validity of AH as an outcome measure of quality and accessibility of primary care; ii) the identification of the most relevant factors influencing the relationship between AH and PC; iii) the characteristic of the rates of AH to be more sensitive to changes in PC policy; iv) the distinctive pattern of acute and chronic ACSC, with chronic ones found as associated with socio-economic conditions and poverty and more difficult to attack than the admissions for acute ones; v) evidence about the better performance of primary healthcare in Italy, with its

Summary

state-regulated HCSs, compared to Germany, which adopt a Bismarckian HCS; vi) the importance of team practice in reducing the risk of AH; vii) evidence about the capacity of GPs to prevent AH in their patients by providing specific assistance to control chronic diseases such as diabetes, heart failure, and COPD.

This study also permitted the estimation of the cost of avoidable admissions in Italy: it was about 480,000 admissions per year for an approximate cost of EUR 1.4 billion. When one considers the cost of these avoidable admissions, there is a clear need to better understand the factors that predict hospitalisation, especially in individuals with chronic disease.

Findings from this thesis provide clues to develop future initiatives that can address the multi-factorial nature of PC service utilisation and hospital admission, as well as to provide for the inclusion of ambulatory specialist care as a possible explanation of differences between HCSs. The strategies to reduce AH are multifaceted, all implying the adoption or the enhancement of public health policies. The main issues are continuity of care, failure to use ambulatory care services, help-seeking behaviour, non-compliance to treatment, fragmentation of health services, budget cuts and increases in chronic disease prevalence. Findings of the thesis support the idea that profound reflection is needed in order to revise and reorganise the Italian NHS, i.e. in the part that relates to PC. In the new model of PC it is mandatory to work in a multi-professional manner, with the use of new structures of reference for the provision of PC with interdisciplinary integration. This was the approach adopted in Italy that inspired the recent law that has introduced a new model of primary healthcare.

In Europe, countries are looking for solutions to create more coherence and coordination in care to address the problem of a lack in responsiveness to the needs of populations. PC is seen as the part of the HCS where this problem can be tackled to a large extent. The problem is to find valid measures to compare the performance of PC within countries and across different countries. This is quite difficult because of the diversity of the structures and financing methods of PC across European HCSs. AH, as an outcome measure of the quality and accessibility of PC, is often easy to calculate, as hospital records are nowadays available in any developed country, reliable and amenable to be used for comparisons. With this study we provided further evidence about the validity of AH as a measure of PC performance. The role of GPs and the organisation of PC in this field are crucial. Findings were derived mostly from data from the Italian HCS, and could be tested in other contexts using the methodology presented here.

Acknowledgement

This project was conducted in collaboration with the Agency of Public Health of Lazio Region, the Department of Public Health of the University of the Sacred Heart of Rome, the Faculty of Health, Medicine and Life sciences of Maastricht University, the Netherlands institute for health services research (NIVEL), Utrecht and the Department of Health Sciences/Public Health, Technical University, Dresden.

Samenvatting

Primary Care (PC) kan worden omschreven als een direct toegankelijke, ambulante professionele generalistische zorgvoorziening. PC wordt gekenmerkt door zijn toegankelijkheid voor de bevolking, ongeacht de aard van de gezondheidsproblemen en wordt geleverd dichtbij de mensen thuis. Naast curatieve zorg biedt PC ook preventieve zorg en gezondheidsvoorlichting. In vele Europese landen zijn huisartsen de belangrijkste verschaffers van deze eerstelijnszorg. Vermijdbare ziekenhuisopnamen worden beschouwd als een gevolg van de mate van toegankelijkheid en kwaliteit van Primary Care. Ondanks veel onderzoek op dit gebied, is er nog geen helderheid over de definitie van voorwaarden waaronder ziekenhuisopnamen als vermijdbaar kunnen worden beschouwd en ook niet over de factoren die van invloed zijn op dit verschijnsel. De belangrijkste vraagstukken in dit proefschrift betreffen: i) de factoren die het verband tussen de beschikbaarheid van primary care en vermijdbare ziekenhuisopnamen beïnvloeden ii) de variatie van vermijdbare ziekenhuisopnamen in de tijd gezien en op regionaal niveau in Italië iii) de verschillende rollen van primary care in twee landen met verschillende stelsels van gezondheidszorg namelijk Italië en Duitsland iv) het verband tussen specifieke activiteiten van huisartsen en vermijdbare opnamecijfers.

Hoofdstuk 1 gaat over het begrip vermijdbare ziekenhuisopnamen en de invloed van primary health care daarop; in dit hoofdstuk worden de onderzoeksproblemen beschreven en de onderzoeksvragen gesteld. Het begrip Vermijdbare Ziekenhuisopnamen kwam naar voren in de Amerikaanse gezondheidszorg in de jaren zeventig. Vermijdbare Ziekenhuisopnamen werden al snel geformuleerd als Ziekenhuisopnamen ten gevolge van voor eerstelijnszorg gevoelige aandoeningen (in het Engels: Ambulatory Care Sensitive Conditions), dat wil zeggen: een groep aandoeningen waarvoor eerstelijnszorg cruciaal is in het voorkomen van een opname in het ziekenhuis, namelijk storingen van de hydro-elektrolytische stofwisseling, pneumonie, bloedende en geperforeerde maagzweren, blindedarmonsteking met complicaties, urinewegonsteking, bekkenbodem ontstekingen, chronische aandoeningen als diabetes, geamputeerde onderste ledematen bij diabetespatiënten, hypertensie, angina pectoris, hartfalen, astma en COPD. Vermijdbare Ziekenhuisopnamen maken deel uit van de indicatoren voor kwaliteit van preventie die zijn ontworpen door het (Amerikaanse) Agentschap voor Gezondheidszorgonderzoek en Kwaliteit van zorg om vast te stellen welk soort ziekenhuisopnamen voorkomen zouden kunnen worden door inzet van adequate eerstelijnszorg.

Deze indicatoren worden breed ondersteund en zijn overgenomen door verschillende Amerikaanse deelstaten. Teneinde deze bevindingen toepasbaar te maken voor de Italiaanse gezondheidszorg hebben we een aantal studies opgezet, die de kern vormen van dit proefschrift.

In hoofdstuk 2 doen we verslag van een systematisch literatuuronderzoek naar de sleutelfactoren die het verband tussen primary care en vermijdbare

Samenvatting

ziekenhuisopnamen wereldwijd beïnvloeden waarbij we de vraag proberen te beantwoorden over het verband tussen de toegankelijkheid van primary care en vermijdbare ziekenhuisopnamen zowel in de tijd gezien als in verschillende systemen van gezondheidszorg.

Kwaliteit en toegankelijkheid van primary care werden door een viertal indicatoren in de literatuur het vaakst beschreven: 1) het aantal huisartsen per 1000 inwoners, 2) de aanwezigheid van of het aantal 'community health centres' (publieke gezondheidscentra) in woongebieden, 3) het aantal contacten met huisartsen of medisch specialisten en 4) de beschikbaarheid van speciale primary care programma's. Sociaal economische omstandigheden vormen een erkende risicofactor voor het aantal vermijdbare ziekenhuisopnamen, bleek uit een aantal studies. Hoger opgeleiden lopen een verminderd risico op een vermijdbare ziekenhuisopname dan mensen met een lagere opleiding.

Behalve sociaal economische omstandigheden zijn er nog enkele zogenaamde contextuele factoren die het verband tussen primary care en vermijdbare ziekenhuisopnamen beïnvloeden, zoals de epidemiologie van bepaalde ziekten of het aantal beschikbare ziekenhuisbedden in een gebied. Deze factoren komen aan de orde in hoofdstukken 4, 5 en 6 in verschillende gebiedsstudies met de gepaste statistische methoden.

Een algemene bevinding uit de literatuur was, tot slot, dat er eigenlijk twee soorten vermijdbare ziekenhuisopnamen zijn: opnamen voor acute en chronische aandoeningen. Bij beide soorten is de rol van primary care verschillend. Opnamen voor acute aandoeningen kunnen vermeden worden door preventie of vroegtijdige ontdekking of behandeling; het vermijden van opnamen voor chronische aandoeningen vergt vooral een goed georganiseerde controle en management. Daarom wordt in dit proefschrift het onderscheid tussen opnamen voor acute versus chronische aandoeningen consequent doorgevoerd.

In hoofdstuk 3 analyseerden we de verdeling van de vermijdbare opnamereeksen over een langere periode. In Italië daalden ziekenhuisopnamecijfers de afgetopen 20 jaar gestaag. Het is daarom aannemelijk dat ook vermijdbare opnamen daalden. We hebben geprobeerd de vraag te beantwoorden of de trend in vermijdbare ziekenhuisopnamen afweek van de trend in het algemene opnamecijfer. Hiertoe werden over de periode 2001-2008 de trends in beide reeksen geanalyseerd voor de 21 Italiaanse gezondheidsregio's. We vonden dat de vermijdbare opnamereeks niet sterker daalde dan de algemene reeks in de bestudeerde periode. Wel vonden we een verschil in trends tussen vermijdbare opnamen voor acute aandoeningen versus vermijdbare opnamen voor chronische aandoeningen: een lichte stijging voor de acute vermijdbare opnamen en een, niet statistisch significante, daling voor de vermijdbare opnamen wegens chronische aandoeningen. Bovendien konden we plausibel maken dat vermijdbare ziekenhuisopnamen sterker dan de algemene opnamecijfers reageerden op veranderingen in het eerstelijnszorgbeleid zoals de Introductie van innovatieve vormen van teamvorming in de huisartsenzorg, die, aan

het eind van de jaren negentig, van start gingen en in de jaren daarna steeds talrijker werden.

De verwachting was dat in regio's, waar mensen de eerstelijnszorg krijgen die ze nodig hebben vermijdbare ziekenhuisopnamen lager zijn. Daar staat tegenover dat in gebieden waar de toegang tot medische zorg beperkter is vermijdbare opnamecijfers hoger zullen zijn. In Hoofdstuk 4 beantwoordden we de onderzoeksvraag naar de factoren die het verband tussen primary care en vermijdbare ziekenhuisopnamen beïnvloeden en de oorzaak vormen van de variabiliteit in vermijdbare opnamen binnen de Italiaanse regio's. De analyses werden afzonderlijk voor (opnamen voor) acute en chronische aandoeningen en voor mannelijke en vrouwelijke opgenomen patiënten uitgevoerd met als mogelijk verklarende factoren de neiging tot hospitalisatie en de epidemiologie van enkele geselecteerde aandoeningen.

In Italië hebben vermijdbare ziekenhuisopnamen een aandeel van 8 procent van het totale aantal opnamen en is de verhouding acuut/chronisch binnen de vermijdbare opnamen 1:2. We vonden duidelijke regionale patronen en verbanden: opnamen voor acute aandoeningen vonden we vaker in Noord-Italië bij ouderen en bij vrouwen in de vruchtbare leeftijd. Vermijdbare opnamen voor chronische aandoeningen vonden we vaker in Zuid- Italië vooral bij vrouwen.

In hoofdstuk 5 bestudeerden we de verschillen in de rol van primary care in twee landen met verschillende systemen van gezondheidszorg: Italië en Duitsland. Italië en Duitsland vertonen overeenkomsten en verschillen in de organisatie van hun stelsels van gezondheidszorg; zij waren daarom geschikt voor een vergelijkende test met betrekking tot de rol van primary care in het reduceren van vermijdbare ziekenhuisopnamen. Een vergelijking tussen landen met verschillende systemen van gezondheidszorg kan helpen om de verschillende posities van primary care te begrijpen en de invloed daarvan op de reductie van vermijdbare ziekenhuisopnamen. Ook is het aannemelijk dat vermijdbare ziekenhuisopnamen in verschillende landen een verschillende rol spelen bij het duiden van verschillen in kwaliteit en toegankelijkheid van primary care. Wij hebben voor de jaren 2000 en 2008 in beide landen de geografische verschillen in vermijdbare ziekenhuisopnamen geprobeerd te verklaren met het zelfde analytische model. We vonden duidelijke patronen in de geografische verdeling van ziekenhuisopnamen. De multilevel modellen die we voor de studies gebruikten, lieten zien, zelfs na controle voor sociaal economische verschillen, dat Zuid-Italiaanse regio's en regio's in Oost-Duitsland hogere aantallen vermijdbare ziekenhuisopnamen voor chronische aandoeningen vertoonden. Beide landsdelen hebben niet alleen een lager Bruto Binnenlands Product per hoofd van de bevolking, maar ook een lager niveau van gezondheidszorgvoorzieningen. Voor beide landen vormen de sociaal economische omstandigheden in respectievelijk het Zuiden (Italië) en het Oosten (Duitsland) nog altijd een serieuze beleidsuitdaging. Overigens had Duitsland so wie so een 40 procent hoger niveau van vermijdbare ziekenhuisopnamen dan Italië, maar dit niveauverschil was toch niet statistisch significant. De bevindingen ondersteunen de hypothese dat het Italiaanse systeem van gezondheidszorg op dit punt beter zou presteren.

Samenvatting

Het vermogen van huisartsen om bij acute aandoeningen een vroege diagnose te stellen (of, indien mogelijk, in een vroeg stadium tot behandeling over te gaan) en de continue controle en management van chronische aandoeningen kunnen een rol spelen bij het voorkomen van vermijdbare ziekenhuisopnamen. Dit vermogen kan gemeten worden door middel van specifieke indicatoren in de context van continuïteit van zorg, de veelomvattendheid, kwaliteit en de efficiëntie van huisartsenzorg. In hoofdstuk 6 beantwoordden we de onderzoeksvraag naar de rol van huisartsen bij het voorkomen van vermijdbare ziekenhuisopnamen door middel van een studie waarin gebruik werd gemaakt van gegevens op individueel niveau uit het Gezondheidszorg Informatie Systeem van de regio Lazio (Rome en omgeving). In deze studie konden we het verband tussen een specifieke set indicatoren op huisartsniveau en de kans op vermijdbare ziekenhuisopnamen bestuderen. Deze indicatoren waren: het aantal ingeschreven patiënten per huisarts, het werken in een groepspraktijk, de hoeveelheid voorgeschreven geneesmiddelen in DDDs uitgedrukt, het aantal en de soort voorgeschreven diagnostische tests per patiënt en het aantal bezoeken van ingeschreven patiënten aan de afdeling Spoedeisende Hulp met een relatieve lage urgentiegraad. We vonden een (negatieve) relatie tussen werken in groepsverband door huisartsen en het vermijdbare opnamecijfer, in het bijzonder als rekening werd gehouden met de eerder genoemde minder urgente bezoeken aan afdelingen SEH, die men als onnodig kan betitelen.

Deze studie vormt een stukje bewijs voor de geldigheid van vermijdbare ziekenhuisopnamen als een uitkomstmaat van kwaliteit en toegankelijkheid van eerstelijnszorg.

Tenslotte werden de bevindingen uit alle studies nog eens op een rij gezet en bediscussieerd in hoofdstuk 7. Dit hoofdstuk bevatte tevens een aantal aanbevelingen voor vervolgonderzoek en met name voor het Italiaanse gezondheidszorgbeleid. De belangrijkste bevindingen betroffen de volgende onderwerpen: i) de geldigheid van vermijdbare ziekenhuisopnamen als uitkomstindicator voor kwaliteit en toegankelijkheid van primary care ; ii) het identificeren van de belangrijkste factoren die het verband tussen vermijdbare opnamen en primary care beïnvloeden; iii) de gevoeligheid van 'vermijdbare opnamen' voor veranderingen in het eerstelijnszorgbeleid; iv) het voor onderzoek en beleid relevante onderscheid tussen vermijdbare opnamen voor acute versus chronische aandoeningen, waarbij vermijdbare opnamen voor chronische aandoeningen een duidelijk verband met sociaal economische omstandigheden vertonen en dus moeilijker met gezondheidszorgbeleid te attaqueren zijn dan vermijdbare opnamen wegens acute aandoeningen ; v) aanwijzingen dat op het gebied van primary health care en vermijdbare ziekenhuisopnamen het Italiaanse NHS stelsel van gezondheidszorg beter lijkt te presteren dan het Duitse Bismarckiaanse systeem; vi) het belang van werken in groepsverband voor huisartsen bij het voorkomen van vermijdbare ziekenhuisopnamen en tenslotte vii) aanwijzingen voor het vermogen van huisartsen om vermijdbare ziekenhuisopnamen voor hun patiënten te voorkomen door specifieke diagnostiek en behandeling aan te bieden bij het beheersen van chronische aandoeningen als diabetes, hartfalen, astma en COPD.

Deze studie maakte het bovendien mogelijk om kosten te berekenen die met vermijdbare ziekenhuisopnamen in Italië gepaard gaan. Het betrof hier 480.000 opnamen per jaar die al met al 1.4 miljard euro aan kosten met zich meebrachten. Alleen deze kosten al rechtvaardigen nader onderzoek naar vermijdbare ziekenhuisopnamen vooral onder mensen met chronische aandoeningen.

De bevindingen van deze studie verschaffen aanwijzingen voor toekomstige initiatieven die de samenhang tussen het gebruik van eerstelijnszorg en ziekenhuisopnamen tot onderwerp hebben. Hierbij moeten dan ook andere vormen van zorg, zoals ambulante (poliklinische) specialistische zorg en ziekenhuiszorg op dagbasis, dus zonder verblijf, worden betrokken. Het is zeer aannemelijk dat ook deze vormen van gezondheidszorg verschillen tussen landen en regio's in aantallen vermijdbare ziekenhuisopnamen beïnvloeden. Strategieën om het aantal vermijdbare opnamen terug te brengen moeten verschillende aspecten omvatten, die alle het omarmen of versterken van volksgezondheidsbeleid inhouden. De belangrijkste onderdelen zijn: continuïteit van zorg, de onmogelijkheid gebruik te maken van eerstelijnszorg, hulpzoekgedrag, het niet opvolgen van voorgeschreven behandelingen, versnipperde gezondheidszorg, bezuinigingen en het toenemen van chronische aandoeningen. De bevindingen van dit proefschrift ondersteunen de gedachte dat dat een diepgaande bezinning nodig is op het herzien en reorganiseren van de Italiaanse gezondheidszorg in het algemeen en in het bijzonder van de eerstelijnszorg. In het nieuwe model van huisartsenzorg is het verplicht om in multiprofessioneel verband het huisartsenberoep uit te oefenen in nieuwe structuren en interdisciplinaire integratie. Deze aanpak lag ten grondslag aan recente wetgeving inzake een nieuw model voor eerstelijnszorg in Italië.

In Europa zoeken landen naar oplossingen die meer samenhang en samenwerking scheppen teneinde tegemoet te komen aan het probleem dat er te slecht wordt ingespeeld op de zorgbehoeften van de bevolking. Primary Care wordt beschouwd als het onderdeel van de gezondheidszorg dat het beste tegemoet komt aan dit vraagstuk. Het probleem is echter om geldige indicatoren te vinden om prestaties van primary care systemen van gezondheidszorg tussen landen en binnen landen te kunnen vergelijken. Dit is lastig vanwege de diversiteit in structuur en financiering van eerstelijnszorg in Europa. (Vermijdbare) ziekenhuisopnamen zijn echter tegenwoordig goed vastgelegd als onderdeel van de administratie van ziekenhuisopnamen en kunnen worden beschouwd als uitkomstindicatoren van de wijze waarop primary care en ziekenhuiszorg in een land zijn georganiseerd (met name wat betreft kwaliteit en toegankelijkheid van primary care). De rol van de huisarts en de organisatie van primary care zijn in dit opzicht cruciaal. Onze bevindingen zijn vooral ontleend aan de Italiaanse NHS, maar ze kunnen in andere landen worden getoetst gebruik makend van de in dit proefschrift gehanteerde modellen en methoden.

Samenvatting

Verantwoording

Tot slot danken wij de volgende instellingen die bij het tot stand komen van deze studie behulpzaam zijn geweest: het Agenschap voor Public Health van de regio Lazio in Rome, Italië, de vakgroep Public Health van de Heilig Hart Universiteit te Rome, de Faculteit Health, Medicine en Life Sciences, van de Universiteit Maastricht, het Nederlands Instituut voor gezondheidszorgonderzoek (NIVEL) te Utrecht en de vakgroep Gezondheidswetenschappen en Public Health van de Technische Universiteit te Dresden.

Sintesi

L'assistenza primaria (AP) è definita dall'organizzazione mondiale della sanità come un'assistenza integrata sociale e sanitaria centrata sulla persona, la famiglia, la comunità. L'AP costituisce la porta di accesso, il primo contatto delle persone, della famiglia e della comunità con il Servizio Sanitario. Nell'ambito dell'AP sono fornite cure di primo livello (CP) indipendentemente dalla natura del problema sanitario. Oltre a fornire assistenza curativa, l'AP si occupa di offrire cure preventive e informazioni per l'educazione sanitaria. In molti paesi europei, i medici di medicina generale (MMG) sono i principali fornitori di CP.

Nella letteratura scientifica i ricoveri ospedalieri evitabili sono riportati come una misura di esito e della qualità dell'AP. Nonostante la grande quantità di studi in questo settore, c'è ancora poca chiarezza circa la definizione delle condizioni per le quali il ricovero può essere considerato evitabile e sui fattori di rischio ad esso associati. La presente tesi mira a investigare il concetto di ospedalizzazione evitabile (OE) e il ruolo che l'AP svolge nel contenere questo fenomeno.

Gli obiettivi perseguiti possono sintetizzarsi nei seguenti punti i) lo studio dei fattori che influenzano il rapporto tra assistenza primaria e ospedalizzazione evitabile ; ii) l'analisi temporale e spaziale (per regioni) della variabilità dei tassi di OE in Italia; iii) le differenze nel ruolo dell'AP in due paesi con diversi sistemi di assistenza sanitaria: i casi di Italia e Germania; iv) il rapporto tra le attività specifiche dei medici di famiglia e il ricorso all'OE dei loro assistiti.

Nel capitolo 1 abbiamo affrontato la concettualizzazione del problema e abbiamo definito le questioni cui lo studio vuole rispondere. Il concetto di OE nasce all'interno del sistema sanitario degli Stati Uniti nei primi anni settanta. L'OE è generalmente intesa come l'ospedalizzazione per le condizioni trattabili attraverso le cure ambulatoriali. Si tratta di un'insieme di condizioni patologiche per le quali il ruolo dell'AP è fondamentale in termini di prevenzione del ricovero. Si tratta di patologie acute come la tubercolosi, la polmonite, l'ulcera perforata con emorragia, l'appendicite acuta con complicazioni, l'infiammazione pelvica e di patologie croniche come il diabete, l'ipertensione, l'angina, l'insufficienza cardiaca, la BPCO, l'asma. Il tasso di OE fa parte degli indicatori di qualità progettati dall'Agenzia per la Ricerca Sanitaria e Qualità degli Stati Uniti per misurare la quota di ospedalizzazioni che avrebbero potuto essere evitata con cure appropriate fornite a livello di AP. L'OE è un indicatore che gode di ampia condivisione ed è stata adottata in diversi Stati degli USA per monitorare la qualità dell'AP. Per utilizzare questa misura anche nel contesto italiano abbiamo progettato una serie di studi che formano il nucleo di questa tesi.

Nel Capitolo 2 viene presentata una revisione sistematica della letteratura sul tema dell'OE attraverso la quale sono stati identificati i fattori chiave che influenzano il rapporto tra OE e AP in diversi sistemi sanitari. Per misurare la qualità e l'accessibilità dell'AP sono quattro gli indicatori più frequentemente citati nella

letteratura scientifica: il numero di medici per 1.000 abitanti; la presenza (o il numero) di centri sanitari di assistenza primaria nelle aree di residenza; il numero di visite effettuate per paziente; la disponibilità di programmi di assistenza sanitaria primaria avanzati. Le condizioni socio-economiche sono un fattore di rischio riconosciuto per l'OE, e vengono prese in considerazione in molti studi: i pazienti che hanno migliori livelli di scolarità presentano rischi inferiori di ricovero ospedaliero per cause evitabili. Insieme alle condizioni socio-economiche ci sono altri fattori di contesto che possono influenzare la relazione tra la performance dell'AP e l'OE, come l'epidemiologia delle malattie considerate e la disponibilità di posti letto negli ospedali per acuti. Questi fattori sono stati valutati nei capitoli 5 e 6 a diversi livelli geografici, utilizzando opportuni modelli statistici.

L'AP svolge un ruolo diverso nella prevenzione dell'OE per le patologie acute e per le croniche. Le patologie acute si prevengono o attraverso diagnosi precoce (e trattamento) della condizione o del suo precursore; quelle croniche attraverso un buon controllo e la continuità delle cure. Per questo motivo, le condizioni acute e croniche devono essere analizzati separatamente. Nel capitolo 3, abbiamo analizzato la distribuzione dei tassi di OE rilevati in Italia, dove i tassi di ospedalizzazione generale sono in costante diminuzione da almeno 20 anni. Pertanto, è verosimile osservare una diminuzione dell'ospedalizzazione anche per le cause evitabili. Per verificare ciò è stato analizzato l'andamento dell'ospedalizzazione nelle regioni italiane negli anni che vanno dal 2001 al 2008 ed è stato rilevato - come previsto - che i tassi di OE hanno avuto un andamento analogo a quello dell'ospedalizzazione generale nel periodo studiato. Analizzando più approfonditamente i tassi di OE abbiamo osservato che le condizioni evitabili acute e quelle croniche hanno mostrato pattern diversi: in lieve aumento le condizioni acute; in decremento quelle croniche. Si è inoltre rilevato come i ricoveri per cause evitabili sono più sensibili ai cambiamenti nella politiche sanitarie riguardanti l'AP, in particolare gli aspetti organizzativi derivanti dall'introduzione di forme innovative di forme associative, nate alla fine del 1990 e diventate sempre più comuni.

In Italia l'OE rappresenta l'8% dei ricoveri totali, di cui 35,7% per condizioni acute e il 64,3% per quelle croniche. Analizzando la distribuzione per area geografica dei tassi di OE, ci si attende che i tassi siano inferiori dove gli assistiti ricevono le CP nella misura in cui ne hanno bisogno. Al contrario, nelle aree in cui l'accesso all'AP è limitato, i tassi di OE tendono ad essere più elevati. Nel Capitolo 4 sono stati investigati i fattori che influenzano la relazione tra AP e OE e la loro variabilità tra le regioni italiane. Le analisi sono state condotte separatamente per condizioni acute e croniche e per genere, considerando come possibili fattori di contesto la propensione al ricovero, e l'epidemiologia delle condizioni selezionate. L'OE per condizioni acute ha mostrato tassi più elevati nelle regioni del nord, tra gli anziani e le donne in età riproduttiva; l'OE per patologie croniche ha mostrato tassi più bassi nelle regioni del nord e tassi più elevati nelle regioni del sud, in particolare tra le donne.

Nel capitolo 5 abbiamo affrontato il tema delle della capacità dell'AP di prevenire l'OE in paesi con differenti sistemi sanitari, analizzando il caso di Italia e Germania. Italia e

Germania sono paesi con somiglianze e differenze nell'organizzazione dei sistemi sanitari, per questo motivo sono adatti ad un test comparativo: entrambi hanno una copertura universale dell'assistenza sanitaria e un sistema di cure avanzato, il sistema italiano è governato centralmente – negli aspetti fondamentali - e finanziato con la fiscalità generale, mentre quello tedesco è di tipo mutualistico. I confronti tra paesi con differenti Sistemi Sanitari possono essere utili per comprendere meglio la relazione tra AP e OE in paesi che adottano diversi modelli di AP. Nello studio condotto abbiamo confrontato la distribuzione geografica dei tassi di OE nei due paesi negli anni dal 2000 al 2008. Utilizzando dei modelli poissoniani multilivello, in grado di controllare per le caratteristiche socio-economiche di contesto, si sono evidenziati dei chiari pattern geografici dei tassi di ospedalizzazione: nelle regioni meridionali italiane e in quelle orientali della Germania con un rischio di essere ospedalizzati per condizioni croniche più elevato. Queste aree hanno entrambe un PIL pro capite più basso e soffrono di carenze di risorse sanitarie. La Germania ha tassi di OE più elevati del 40% rispetto in Italia. Tale evidenza supporta l'ipotesi di una migliore performance dell'assistenza primaria nel sistema sanitario italiano.

La capacità dei MMG di fornire una diagnosi precoce (e il trattamento quando possibile) delle condizioni acute, il controllo e le cure continue nella gestione delle malattie croniche gioca un ruolo fondamentale nella prevenzione dell'OE. Tali capacità possono essere misurate attraverso indicatori specifici nel contesto della continuità delle cure e della qualità e l'efficienza dell'AP. Nel capitolo 6 abbiamo investigato il ruolo dei MMG nella prevenzione dell'OE attraverso uno studio che ha utilizzato dati individuali dei pazienti, distinti per singolo MMG curante, desunti dal Sistema Sanitario Informativo della regione Lazio. Lo studio ha analizzato la relazione tra ricoveri evitabili e una specifica serie di indicatori relativi alle attività dei MMG: l'adesione alle varie forme di medicina in associazione, il numero di farmaci prescritti – in termini di dose definita giornaliera (DDD) - per paziente, il numero e il tipo di accertamenti diagnostici prescritti per paziente e il numero di accessi in PS con codice bianco. L'effetto positivo che ha la medicina in associazione è stato chiaramente evidenziato, soprattutto nell'associazione tra OE e l'accesso in PS con i codice bianco (pazienti non urgenti), che può essere considerato come un accesso inappropriato. Anche la prescrizione di prestazioni diagnostiche si è dimostrato avere un ruolo importante, specie nella prevenzione dei ricoveri evitabili per patologie croniche. Lo studio costituisce un'ulteriore evidenza a favore della validità dell'OE come misura della qualità e l'accessibilità dell'AP.

Infine, nel capitolo 7 sono stati riassunti e discussi gli studi condotti e sono state proposte alcune raccomandazioni per la ricerca e per l'implementazione politiche sanitarie in Italia. In sintesi, la presente tesi ha fornito evidenze sui seguenti elementi: i) la validità dell'OE come misura della qualità e accessibilità delle cure primarie; ii) l'identificazione dei fattori più importanti che influenzano la relazione tra OE e AP; iii) la caratteristica dei tassi di OE di essere più sensibili ai cambiamenti nella politiche riguardanti l'organizzazione dell'AP; iv) il pattern distinto tra patologie acute e croniche, con quelle croniche maggiormente associate alle condizioni socio-economiche; v) la migliore performance dell'assistenza sanitaria primaria in Italia, con il suo sistema sanitario regolamentato a livello centrale, rispetto alla Germania,

che adotta un sistema mutualistico; vi) l'importanza della medicina in associazione nel ridurre il rischio di OE; vii) le evidenze circa la capacità dei MMG di prevenire il ricorso a ospedalizzazioni evitabile nei loro pazienti, fornendo assistenza specifica per il controllo di malattie croniche come il diabete, l'insufficienza cardiaca e BCPO.

Questo studio ha anche permesso la stima del costo dei ricoveri evitabili in Italia, che è stato di circa 1,4 miliardi di euro per 480.000 ricoveri annui (dato riferito all'anno 2005). Tale impatto economico è sicuramente un valido incentivo a comprendere meglio i fattori che sono in grado di prevenire il ricovero in ospedale, soprattutto in pazienti con malattie croniche. I risultati di questa tesi forniscono elementi per lo sviluppo di iniziative future che possano affrontare il tema di un miglior utilizzo dei servizi di AP, prevedendo di considerare in futuri studi anche l'ambito delle cure specialistiche ambulatoriali come una possibile fattore in grado di spiegare le differenze che si riscontrano nei tassi di OE tra diverse aree e diversi sistemi sanitari. Le strategie per ridurre l'OE sono molteplici, tutte implicano l'adozione o il potenziamento di politiche di sanità pubblica. I principali problemi sono la continuità delle cure, il mancato utilizzo dei servizi di assistenza ambulatoriale, la non-compliance ai trattamenti farmaceutici, la frammentazione dei servizi sanitari, oltre a fattori contingenti come la riduzione di finanziamenti alla sanità e l'aumento nella prevalenza delle malattie croniche. Le evidenze esposte supportano l'idea che una profonda riflessione sulla riorganizzazione dell'assistenza primaria è necessaria. Nel nuovo modello di AP è fondamentale lavorare in modo più professionale, con l'uso di nuovi modelli organizzativi e attraverso una maggior integrazione interdisciplinare. Questi elementi sono presenti nei recenti provvedimenti normativi riguardanti le AP adottati in Italia che prefigurano un nuovo modello di assistenza sanitaria primaria. In Europa, i paesi sono alla ricerca di soluzioni per creare maggiore coerenza e coordinamento dei diversi livelli di cura. L'AP è un settore fondamentale dei sistemi sanitari ed è l'ambito in cui affrontare meglio i problemi della sanità. È quindi cruciale trovare misure valide per confrontare la performance dell'assistenza primaria all'interno dei paesi e tra paesi diversi. Questo è molto difficile a causa della diversità delle strutture e dei metodi di finanziamento dell'AP. L'OE, come misura della qualità e l'accessibilità dell'AP, è uno strumento di facile calcolo, visto che i registri delle dimissioni ospedaliere sono oggi disponibili in tutti i paesi avanzati, affidabile e adatto ad essere utilizzato per confronti. Con questo studio abbiamo fornito ulteriori evidenze circa la validità dell'OE come misura della performance dell'AP. I risultati presentati riguardano principalmente il contesto italiano. Utilizzando le metodologie presentate, gli studi possono essere facilmente replicati in altri contesti.

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Valorisation note

The quality of health statistics in Italy

In this thesis we made use of current data and statistics derived from the National and Regional Health Informative System (HIS). The Italian HIS covers many aspects of the health system, such as the hospital system, the ED, the ambulatory services as well as drugs provided through drug prescriptions. The completeness, timeliness and reliability of the information derived from the HIS allowed the calculation of indicators relevant to the aims of the thesis. This set of indicators provided a comprehensive summary of the current knowledge of the phenomenon of avoidable hospitalisation, including information on provided hospital and ambulatory services, health systems resources, demographic and socioeconomic statistics. Timely production of valid and reliable data is inherent to the mission of HIS. The ready availability of data produced by the HIS is a significant community resource for improving health.

Analysis of the cost of Avoidable Hospitalisation: possible economic benefits for the healthcare system.

The cost of hospitalisation for ACSCs has been estimated in different contexts: in Canada hospital costs for heart failure were CAD 425 million and for pneumonia CAD 193 million in 2005 (Canadian Institute for Health Information, 2008). In the present thesis we showed for Italy in the same year (2005) hospitalisation for Ambulatory Case Sensitive Conditions (ACSC) accounted for about 480,000 admissions (Rosano, 2011), with an approximate cost of 1.4 billion of euro. Obviously the cost depends on the definition and the number of medical conditions included, thus comparisons are not always possible.

Considering the definition of ACSCs adopted in the studies conducted for this thesis, we have analyzed the number of admissions for ACSCs, the proportion over total admissions and their valorisation in euro in the Lazio region in the period 2005-2013 using the data extracted from the Hospital Information System of the Lazio Region. (Table 1a and 1b)

The Lazio region has 5,8 million of inhabitants, about one tenth of the Italian population. The number of admissions for ACSC decreased in the study period in absolute terms by 18%, but as percentage of total admissions raised from 7.3% to 7.9%. In terms of valorization of the admissions, the burden of AH was stable around 6.5%. The profile of the causes of avoidable admissions has changed: the proportion of acute conditions raised from 27% to 36% and, complementarily, that of chronic conditions dropped from 72% to 65%.

The majority of admissions of ACSCs increasingly occurred among the elderly: from 73% in 2005 to 79% in 2013. We analysed the time series of admissions among patients aged 64 years and over in the Lazio region (Table 2).

Valorisation note

The number of admissions for ACSCs among elderly decreased in the study period in absolute terms by 13%, but remained stable as percentage of hospital admissions, with a small decrease in terms of valorisation.

The most recent figure of AH in the Lazio region shows as the cost of admissions for ACSCs is 133 million euro, 37% of which for acute conditions and 63% for chronic conditions. The evidence from the thesis showed the capacity of a good quality and well organized PC assistance to reduce the risk of AH. In particular the organization of GP activity as team practice has been shown to reduce by 7% the risk of AH for acute conditions and by 5% for asthma, hypertension and diabetes. Team practice showed an apparent effect also in terms of reduction of the rate risk of inappropriate access to Emergency Departments (-25%). Such a finding is in accordance with a recent review on the topic which showed that higher levels of provider continuity decrease the risk of avoidable hospitalization for ACSC and chronic diseases, regardless of country and age groups (van Loenen, 2014).

Team practice, in the various forms provided in the Italian system, guarantees: continuity of care; availability of GPs for more hours per day and days per week; and adherence to guidelines and innovative projects. It seems that this organizational aspect has a greater impact on AH than other tools, such as Pay-for-Performance programs with the offer additional payments to GPs (Fiorentini, 2011). Other studies showed as collaboration between primary care physicians and other community-based health care providers within primary care networks (Manns, 2012; Sommers 2000) and adherence to guidelines (O' Malley, 2007; Cloutier MM, 2005) is associated with a reduction of hospitalization rates overall.

Here we have presented for the first time in the Lazio Region an estimated cost of AH as well as its time trend in the last 9 years. The Lazio region, as other Italian regions with budget constraints, between 2006 and 2011 has reduced the healthcare expenditure in real terms. The indications of the Ministry of Health for a spending review (Health Pact 2010-2012 and Law 135/2012) were aimed at: reducing the number hospital beds; reducing the number of hospital admissions by increasing the use of appropriateness criteria to avoid unnecessary admissions; reducing the average length of stay. The Lazio region has cut the number of hospital beds, has not replaced the members of the healthcare force who retired and has cut funding for medical supplies, but it has been unable to increase the efficiency of its hospital systems (Francese, 2011; Corte dei conti, 2013). It is evident how difficult is to really influence on the hospital system, due to its rigidity and complexity. Further budget cuts on the hospital sector jeopardize the provision of the necessary health services. The adoption of appropriateness measures, investments in information systems, and organisational arrangements that integrate primary, secondary and social care are the way forward. The idea proposed to health policy makers in this thesis is to act on primary care, improving its accessibility and performance in order to reduce the hospitalization for avoidable conditions. It is not about to reduce unnecessary hospitalization, but to avoid that patients' health status worsens in a way that hospitalization becomes necessary. Probably to intervene in the organization of PC is

simpler, even if results will not be apparent in a short term. The intervention on PC could be more organizational rather than financial.

A proposal for a new national contract for GPs

Financial incentives in primary care have been introduced with the purpose of improving appropriateness of care and containing demand. In Italy their effectiveness has been showed to be limited, in particular in containing expenditure for avoidable and total hospital admissions (Fiorentini, 2013). In order to improve the performance of PC other options could be followed, such as changes in the national contract of GPs, now based mainly on a fee per capita remuneration. A new approach, based on a mix of capitation and salary (with a fixed maximum, as it is now) remuneration system. This would encourage GPs to dedicate more time to continuity of care and coordination of the activities, other than training and research. (Milillo, 2009)

The total remuneration of the GP may increase over time with professional growth through the enhancement of the hours devoted to more complex tasks such as coordination of care, training, teaching. The mix of capitation and salary remuneration system may be accompanied by other pay systems to reward the quantity and quality of work, such as fee-for-service and pay for performance, in which the remuneration is linked to the achievement of specific targets. There is a need for a more appropriate weighting of capitation, linked to patients' age and related to the absorption of resources, using, e.g., an index of burden of care resulting from the presence of chronic conditions. The proposed model provides that the GP plays fiduciary activities and partly hourly activities in relation to the different organization of work. Furthermore, considering the gap of the most disadvantaged areas with worse socio-economic conditions and fewer services, it is possible to imagine a system of incentives to make sure that the number of GPs and their work intensity is increased in these areas.

Conclusions

Countries differ in the way they organize their primary care system. Tradition and culture often influence the approach in system policy. What might work in one country might not elsewhere. Teams based around general practice have expanded considerably in the last decades also in other countries, like UK (Usherwood, 1997). Further studies could concern the impact of team practice on AH in different countries. Finally, evidence from the thesis can be used to reform the PHC system and converted in new guidelines to improve the processes in primary care.

Valorisation note

Table 1a. Number of admissions for ACSCs and relevant valorization in thousand of €, in absolute terms and as percentage of total admissions. Hospital Information System of Lazio Region. Years 2005-2013.

Year	Admissions for ACSCs				Total admissions	
	N.	%	Amount in €	%	N.	Amount in €
2005	50,640	7.29	156,574	6.89	694,704	2,272,208
2006	48,408	7.00	151,788	6.42	691,672	2,364,017
2007	45,731	6.86	140,827	6.33	666,429	2,225,062
2008	44,890	6.90	139,241	6.27	650,441	2,221,272
2009	44,101	7.02	140,644	6.41	628,265	2,194,220
2010	43,587	7.17	140,241	6.49	607,509	2,162,318
2011	42,167	7.44	135,275	6.61	566,904	2,046,610
2012	42,356	7.62	136,441	6.66	555,705	2,049,913
2013	41,765	7.86	132,637	6.63	531,668	2,000,373

Table 1b. Number of acute and chronic ACSCs conditions, and relevant valorization in thousand of €, in absolute terms and as percentage of ACSCs admissions. Hospital Information System of Lazio Region. Years 2005-2013.

Year	Acute conditions				Chronic conditions			
	N.	%	Amount in €	%	N.	%	Amount in €	%
2005	13,905	27.5	46,629	29.8	36,735	72.5	109,944	70.2
2006	13,345	27.6	43,807	28.9	35,063	72.4	107,981	71.1
2007	13,253	29.0	43,456	30.9	32,478	71.0	97,337	69.1
2008	13,596	30.3	45,174	32.4	31,294	69.7	94,067	67.6
2009	13,357	30.3	44,336	31.5	30,744	69.7	96,308	68.5
2010	13,865	31.8	46,120	32.9	29,722	68.2	94,122	67.1
2011	13,723	32.5	45,832	33.9	28,444	67.5	89,443	66.1
2012	14,515	34.3	47,967	35.2	27,481	64.9	88,474	64.8
2013	14,971	35.8	48,641	36.7	26,974	64.6	83,996	63.3

Table 2. Number of admissions for ACSCs and relevant valorization in thousand of €, in absolute terms and as percentage of total admissions. Hospital Information System of Lazio Region. Age 64+, Years 2005-2013.

Year	Admissions for ACSCs (age 64+)				Total admissions (age 64+)	
	N.	%	Amount in €	%	N.	Amount in €
2005	37,335	12.0	118,043	10.1	310,084	1,168,787
2006	36,229	11.7	116,499	9.5	309,766	1,227,141
2007	34,551	11.5	108,860	9.4	300,325	1,163,242
2008	34,164	11.6	108,051	9.2	295,086	1,168,560
2009	33,673	11.7	108,962	9.3	288,443	1,169,057
2010	33,238	11.9	108,315	9.4	279,744	1,155,145
2011	32,468	12.4	104,906	9.6	262,131	1,096,588
2012	32,863	12.6	106,470	9.5	261,776	1,116,769
2013	32,539	12.8	103,875	9.4	254,696	1,103,319

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About the author

Aldo Rosano was born on September 27th 1963 in Luino, Italy. He has a B.Sc. degree in Statistics and a M. Sc. degree in Health Statistics. In 2014 he obtained the National Academic Qualification as Associate Professor in Health Statistics and Public Health. From 1993 to 2000 he worked as researcher at the International Centre for Birth Defects (NGO of WHO), than as senior researcher at the Italian Institute of Social Medicine from 2001 to 2006. From 2006 to 2013 he was head of the office "management of hospital care" at the Agency of Public Health of the Lazio Region. During these years he has conducted various studies on primary care and on avoidable hospitalisation in collaboration with the University of the Sacred Heart of Rome and with the National Observatory on Health in the Italian Regions. He coordinated international projects in the field of public health and social epidemiology. He worked in close collaboration with the World Health Organization, the European Commission, and the Italian Ministry of Health. He lectured epidemiology and biostatistics as adjunct professor at the University "La Sapienza" of Rome from 2004 to 2011. He is author of 55 peer reviewed papers, 71 abstracts, 24 research reports, 28 oral presentations at scientific international congresses and editor of 5 scientific books. Aldo Rosano is currently working as Head Statistician at the Department of Health of the Lazio Region.

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List of abbreviation

ACSC	Ambulatory Care Sensitive Conditions
ACSC-HR	Ambulatory Care Sensitive Conditions – Hospitalisation Rate
ACSH	Hospitalization for Ambulatory Care Sensitive Conditions
AFT	Territorial Functional Aggregations
AGENAS	Italian Agency for Regional Health Services
AH	Avoidable hospitalisation
AHR	Avoidable Hospitalisation Rate
ASAH	Age-standardized rates of avoidable hospitalisations
CHF	Chronic Heart Failure
COPD	Chronic Obstructive Pulmonary Disease
DB	Diabetes Mellitus
DDD	Defined Daily Dose
DH	Day Hospital
DP	Diagnostic Procedures
EBM	Evidence-based Medicine
ED	Emergency Department
EU	European Union
GDP	Gross Domestic Product
GK	Gatekeeping System
GP	General Practitioner
HCA	Healthcare Assistant
HCS	Health Care System
HD	Health District
HDR	Hospital Discharge Registry
HF	Heart Failure
HIS	Health Information System
HR	Hospitalization Rate
ICD	International Classification of Diseases
IHS	Italian Healthcare system
IOM	Institute of Medicine
IRR	Incidence Rate Ratio
ISS	Italian Institute of Health
ISTAT	Italian Institute of National Statistics

LHU	Local Health Unit
MIRR	Median Incidence Rate Ratio
ML	Multilevel
NHS	National Health System
OECD	Organisation for Economic Co-operation and Development
OHCS	Outpatient HealthCare Service
PC	Primary Care
PHC	Primary Health Care
RR	Rate Ratio
SEF	Socio Economic Factors
SHR	Standardised Hospitalisation Rate
SSH	Social Security Healthcare
TH	Total Hospitalisation
THR	Total Hospitalisation Rate
UCCP	Complex Primary Care Units
WHO	World Health Organisation