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INCENTIVES IN PRIMARY CARE AND THEIR IMPACT ON POTENTIALLY AVOIDABLE HOSPITAL ADMISSIONS

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Abstract

An increasingly important feature of public policies in healthcare systems is the involvement of primary care physicians in demand control strategies which are aimed to increase the appropriateness of the caring process. Policymakers agree that a more extensive use of financial incentives may promote a higher quality of care, especially for a wide range of pay-for-performance programs, where payment is made contingent on meeting indicators of provider effort. Besides, other strategies have been adopted with physicians rewarded for participation in improvement activities and/or for compliance with guidelines, without specific targets to be met. Given this background, it is necessary to deepen our understanding of the determinants of GP prescribing behaviour, to identify the role played by different financial incentives introduced in primary care in order to improve the allocative efficiency and the quality of care. To this aim, we examine whether the nature of primary care organisation and the features of the contractual arrangements between GPs and the NHS affect the degree of organizational appropriateness measured by a set of medical conditions where timely and effective intervention in primary care could reduce the risk of hospitalization. We investigate the effects of the introduction of economic incentives in Regional and Local Health Authority contracts for primary care in the Italian region Emilia-Romagna in the year 2005, distinguishing pay-for-performance schemes from pay-for-participation and pay-for-compliance programs. Through the use of multilevel modelling, we measure organizational appropriateness testing two dependent variables: the first is the rate of preventable hospitalizations measured by the internationally known ACSCs (ambulatory care-sensitive conditions), the second is a list of 27 medical DRGs that Emilia-Romagna consider at risk of organizational inappropriateness of primary care and that have been monitored for many years.

Keywords

Primary care, preventable hospitalizations, financial incentives, organizational appropriateness, multilevel modelling.

JEL classification: I11, I18, C31

Introduction

In recent years, cost containment efforts, that have characterised healthcare systems, have increased the need to identify where resources might be most efficiently targeted and, in this perspective, the economic and health benefits of appropriate primary care have received increasing attention. In order to promote a higher quality of care, a wide range of pay-for-performance programs has been introduced, where payment is made contingent on meeting indicators of provider effort to deliver high-quality care. In addition to it, other strategies have been adopted, each with its distinctive strengths and weaknesses, with physicians rewarded for participation in improvement activities and/or for compliance with guidelines of care.

The Quality and Outcomes Framework signed in 2003 in the UK is a mix of pay-for-performance and pay-for-compliance schemes in that it makes a substantial part of GP's income (about 30%) contingent on attaining 146 quality indicators, covering clinical care for 10 chronic disease, organisation of care and patient experience. In the US, public and private payers have made available financial incentives (in the range of 1 to 10% of total revenues) to hospitals and other health care providers as well as to individual physicians participating in collecting information and/or meeting quality targets. In Italy, the use of financial incentives in primary care is limited to a small part of GP's total revenue and is mainly based on pay-for-participation programs. So far, only very few studies have investigated the relationship between the quality of clinical outcomes and the specific incentive structure of different programs that ensure financial bonuses to GPs.

Given this background, our study examines whether physicians facing various types of economic incentives for promoting the adoption of organizational appropriateness modify their admission practices for a set of medical conditions where timely and effective intervention in primary care can reduce the risk of inappropriate hospitalization. In particular, we investigate the impact of the introduction of economic incentives in Regional and Local Health Authority contracts for primary care in the Italian region Emilia-Romagna for the year 2005, distinguishing pay-for-performance from pay-for-participation and pay-for-compliance programs. We test the hypothesis that, other things equal, local health authorities that introduced financial incentives to GPs in order to improve organizational appropriateness of health care, were more likely to impact on the probability of an avoidable hospital admission.

The dataset made available by the Regional Agency for Health and Social Care covers patients and GPs of the whole region and allows, through the linking of several epidemiological and

administrative databases, to obtain detailed information on health consumption of the population and on the different components of GP remunerations. We use multilevel analysis (MLe) to assess the joint influence of all the characteristics on the dependent variable (Goldstein, 2003), nesting patients characteristics within general practices and in turn nesting GP characteristics within health districts.

As dependent variables we use two alternative measures of avoidable admissions. The first measure is based on the Ambulatory Care Sensitive conditions (ACSCs) developed by Billings et al. (1993). Admissions for ACSCs are potentially avoidable hospitalisations in the sense that they refer to conditions (*chronic conditions* such as diabetes and asthma, *acute conditions* such as ear/nose/throat infections, and *preventable illnesses* such as tetanus) that, if treated properly on an outpatient setting, would usually not require inpatient admission. These hospital admissions are not necessarily inappropriate in the sense of being unneeded but are avoidable, since effective ambulatory care might have prevented the condition from becoming so severe that admission becomes necessary. Rates of preventable hospitalizations are internationally used to identify socio-economic inequities in access to primary care services and possible deficiencies in the quality of outpatient care. However, also an alternative hypothesis could be tested: the nature and strength of GPs contractual arrangements may significantly influence the variation in admission rates in patients with ACSCs. At this regard, Josephson and Karcz (1997) compare for the US the hospitalization rates of patients with ACSCs among three groups receiving care from primary care physicians compensated under different reimbursement mechanisms and this issue has not been explored in the Italian NHS.

The second outcome we refer to is an indicator of potentially inappropriate hospital admissions identified by 27 medical DRGs selected by the Emilia-Romagna Region as potentially at risk of organizational inappropriateness in primary care. As regards avoidable hospitalisation, Emilia-Romagna has been working for years to improve the appropriateness of hospital use, contracting with GPs to reduce inappropriate or late admissions that may have been avoidable with better outpatient care or with hospitalization at an earlier stage. Consequently, we find it worthwhile to analyse to what extent financial incentives drive allocative decisions in primary care not only focusing on an internationally known measure of avoidable hospitalisations, but also considering the autonomous choice of the Region to select a list of clinical conditions for which an active participation of GPs is strictly required.

The role of incentives and motivation in health care

Agency theory assumes that strong monitoring by the principal should motivate the agent to increase his effort in order to reduce his penalty if caught shirking (Prendergast, 1999; Laffont & Martimort, 2002). Contrariwise, following the "crowding out" theory (Frey & Jegen, 2001), monitoring could be considered as a signal of lack of trust and could diminish effort by reducing pre-existing intrinsic motivation (the desire to perform the task for its own sake) for effort. The same result could hold in case of rewards. The premise of pay-to-perform schemes is to increase agents' marginal benefit of effort towards work outcomes relative to opportunity costs, but, introducing monetary rewards to compensate performance on a task that has been previously undertaken without any immediate monetary remuneration can actually reduce performance. Gneezy and Rustichini (2000) argue that this result may depend on the size of the monetary incentive, with crowding out most likely to occur with modest monetary incentives. On the contrary, external interventions could also crowd "in" intrinsic motivation when there is a high degree of perceived autonomy, discretion and freedom in work activity, personal relationships predominate and employees participate in decision making. In this context, the principal could signal his confidence in the agent's ability and strengthen the agent's intrinsic motivation in the long period.

Empirical studies of performance pay reforms in the private sector show that firms experience significant increases in productivity when switching from flat salary scheme to a pay for output scheme, where firms occasionally suffer decreases in quality when quality is not easily contractible (Lazear, 1996). Studies of performance pay reforms in the public sector are mostly focused on sporadic intervention programs and show mixed results (Heckman, Heinrich & Smith, 1996; Lavy, 2004). Skeptics of high-powered incentives in public organizations argue that using pay-for-performance schemes in the public sector could produce unintended consequences on workers' behaviour and induce extensive gaming by public employees that may lower their productivity (Dixit, 2000; Smith, 1995).

Examining the principal/agent relationship between purchaser and provider in health care, Goddard et al. (2000) stress many risks in the design of compensation mechanisms related to performance. The incompleteness of many performance measures may lead to the so called "tunnel vision", e.g. the concentration on areas included in the performance indicator scheme to the exclusion of other unmeasured areas, but also to some sort of "myopia" when the effort is concentrated on short-term issues, excluding long-term activities which may influence performance measures only in many

years time. Besides, when some outcomes are the results of the joint effort of a number of agencies, it is very difficult to design adequate incentive schemes able to encourage cooperation and becomes possible that only local, relatively narrow, objectives are pursued at the expense of the general organization's objectives. This outcome could be relevant also if it is in the power of the agent to manipulate the reported data, giving rise to "mis-representation" of reported performance. Finally, when multi-period systems of targets and rewards are used, there is a danger of creating a "ratchet effect" when the good performance in one year is punished with higher future targets and the agent has a strong incentive to report persistently mediocre level of performance.

In health care pay-to-perform schemes have rapidly diffused internationally with a considerable heterogeneity in the focus of these initiatives, from primary care to hospitals to regional health care systems, and a variety of methods used to design the incentives and to assess their effects on quality of care. For the 1999 Australian pay-for-performance scheme for GP remuneration in chronic disease management , Scott et al. (2008) find a positive moderate effect on quality of diabetes care. In the US, Cutler (2006) reports that the empirical evidence to date is "more positive than negative", in the sense that payment incentives result to produce some positive impact on the quality of care, but the effects are not all in the same direction. In the English pay-for-performance program, there is evidence of an increase in the quality of care during the first years, but also evidence of gaming and tunnel vision effect (Doran et al. 2006).

To overcome the unintended side effects, health economists suggest some broad strategies (Mannion et al, 2007). The first strategy regards the enhancement of the information base on which both principal and agent base their decisions, in order to reduce the scope for misdirected efforts, and the development of performance benchmarks which are independent of past activity. Another strategy regards the degree of dissonance between the objectives of principal and agent (Smith, 2002). In this case the idea is to create a "culture change", that is to foster a closer alignment between their objective, promoting a favourable cultural environment and encouraging clinical professionals themselves to promote a culture of patient safety that might contribute to ameliorate the agency problem. Following this strategy, payers are exploring alternative incentive schemes for improving quality such as pay-for-participation programs or pay-for-compliance programs. Both solutions generate a looser incentive structure with respect to pay-for-performance, since payments are conditional not on the accomplishment of a specific, easily measurable, target, but simply on personal involvement of GPs in programs aimed at improving the quality of care for specific diseases and/or on the adherence to clinical protocols. The (still very limited) empirical literature on

the topic, based on the experience on surgical care, outlines that there are cases in which this kind of incentives may prove more effective in improving the quality of care (Birkmeier & Birkmeier, 2006; Lippi Bruni, Nobilio & Ugolini, 2009). One of the potential advantages is physicians' acceptance of this approach, together with significant improvement in providers' adherence to evidence-based best practices. On the contrary, incentive schemes that do not condition payments to the achievement of pre-defined individual targets may strongly attenuate the influence on physicians behaviour and could present shortcomings that should not be overlooked. For example, physicians may be induced to avoid, in each group, those patients for whom the additional effort required exceeds the ad hoc transfers, so that the quality of care for them could be even lower than that in a system based on flat capitation.

The Italian primary care system and the Regional strategies for appropriateness

Recent reforms have transformed the Italian NHS, introducing fiscal federalism and giving regions political, administrative and financial responsibility regarding the organisation and provision of publicly financed health care. In particular, the 1992 and 1999 reforms changed significantly primary health care services by reinforcing group practice, experimenting economic incentives for general practitioners and promoting integration between primary care physicians and district services (Fiorentini, Lippi Bruni & Ugolini, 2008; France, Taroni & Donatini, 2005).

Primary care is provided by independent contracted doctors paid on a capitation basis that act as gatekeepers for the access to secondary services. People may choose any physician they prefer, provided that the physician's list has not reached the maximum number of 1500 patients allowed for full-time general practitioners. All GPs work within the Local Health Authorities (LHAs), subdivided into health districts encompassing at least 60,000 inhabitants and geographically responsible for coordinating and providing primary care, non-hospital-based specialist medicine and residential and semi-residential care to their assigned populations.

Their remuneration is regulated by national contracts negotiated every three years between the central government and the GPs' trade unions, but there are growing geographical differences reflecting the increased autonomy of the regions in enforcing national contracts. As an incentive towards containing costs and reducing referrals to hospital for specific specialist treatments, the payment system has been split into three parts: fixed, variable and additional. The fixed part is determined on a capitation basis. The variable part comprises fees for services for specific

treatments, including minor surgery, preventive activities, therapies and post-surgery follow-up. The additional part is a reward for appropriateness and/or effective cost containment and can take the form of pay–for-performance mechanisms, or of other type of financial incentives. The fixed and variable parts are common to all general practitioners and are established nationally, but each region decides whether and how to apply the additional parts. Besides, LHAs can also pay further additional allowances for the delivery of planned care to specific patients, such as home care for chronically ill patients.

Taking advantages of this opportunity, in recent years, many LHAs and districts have contracted with local GPs' professional bodies additional transfers for special programs aimed at improving the quality of care and/or containing expenses. Typically, once the parts agree on a special program, all the GPs of the district involved are automatically admitted into it.

Emilia-Romagna is an Italian region located in the northeast of Italy with about 4 million inhabitants. As for appropriateness, in the last few years the region has been investing much effort to develop an approach to discriminate between appropriate and inappropriate admissions that can be used with existing hospital data. Using DRGs and Disease Staging, a classification was developed and applied to the hospital discharge abstract database to evaluate the level of potentially inappropriate admissions. In particular, Emilia-Romagna has produced in 2004 an "Atlas of appropriateness of hospital use" to assist hospital and local health unit managers in identifying the appropriate level of alternative, lower intensity, treatment settings for patients who do not need acute care hospitalization. Moreover, the region is considering changes to the DRG-based hospital financing system to promote managerial and organizational efficiency. As regards primary care, since 2001 the LHAs experienced varying levels of involvement of GPs in order to shift the emphasis from hospital to community care, recognising that certain conditions refereed to 27 medical DRGs on the whole, need not be hospitalised. They correspond to the principal chronic pathologies: diabetes, asthma, chronic obstructive pulmonary disease and other respiratory diseases, congestive heart failure, hypertension and psychiatric diseases. Consistently, current regional guidelines foster co-ordination between different levels of care and the GPs play a pivotal role in making the initial diagnosis and providing effective care. At local and at district level, different mechanisms of financial incentives have been introduced, mainly in the form of pay-for-performance, pay-for-participation and pay-for-compliance programs.

"Pay-for-performance" programs are characterised by a strict link between the financial transfer and the achievement of targets to be verified ex-post. They are negotiated between LHA and/or district

and GPs trade unions and defined in the contracts signed at the local and district levels as programmed expenditure levels. Examples can be found in the prescription of pharmaceuticals, where GPs are rewarded if they meet predefined ratios in the prescription rate of generic relatively to non-generic drugs. Other examples are represented by local programs that ensure additional payments to those GPs that keep hospitalization rates below predefined thresholds for a series of listed conditions. To each expenditure area is allocated a maximum payment and GPs are rewarded in proportion to the achieved level, with a graduated scale of payments that starts above a minimum threshold level and ends once the maximum threshold level has been reached. As regards hospital care, the primary strategy is to provide incentives for GPs to deliver high quality services in a way that improves clinical and organizational appropriateness and that allocates resources most efficiently and effectively. The main target indicators refer to pathologies for which GPs have the potential to influence the rate of inappropriateness and appropriate setting of care. For example, some local contracts provides financial incentives to reduce avoidable hospital admissions related to the 27 medical DRGs, to limit the standardized ordinary hospitalization rate, to decrease the emergency admissions rate, to increase the number of protected hospital discharges for patients needing follow-up care or treatment after a hospital stay, to reduce hospitalization for elderly patients strengthening the capacity of the home and community care system.

"Pay for participation" programs are an heterogeneous group of programs aimed at encouraging physician's participation in programs for the management of specific conditions (e.g. diabetes, hypertension, oncology, asthma and dementia) which require additional efforts directly devoted to each diagnosed patient. These payments are labelled "pay for participation", in order to distinguish them from "pay for performance" programs where the financial bonus is conditional on the achievement of specific targets. As an example, various districts – though not all - have developed incentive schemes that require physicians to take part in local diabetes management plans in which GPs are entitled to a financial bonus for the assumption of responsibility of each diabetic patient. In this case, the GPs in charge of providing care to patients expected to require higher than average effort - as it is the case for diabetes type II patients - receive an extra payment that supplements standard capitation. In general, the assumption of responsibility implies that patients have to receive from their GP regular reviews, combined with the periodic measure of their glycosylated haemoglobin (HbA1c). In this way, an additional financial transfer is attributed to physicians for each patient with diagnosed diabetes that follows under physician's responsibility. A key feature of this scheme is that, under "pay for participation", the amount received by the GP is defined on a

per-patient basis and, therefore, depends on the number of patients diagnosed with diabetes type 2 included in the list of the GP.

Finally, the label "pay for compliance" comprises a set of activities aimed at fostering GPs' cooperation and endorsement of policymakers' objectives in clinical areas that require particular efforts to ensure clinical appropriateness. Such programs imply that additional compensations are provided for attending audit meetings, for taking part in the process of developing new protocols and guidelines or for implementing the regional evidence-based best practices, for example to improve the level of local immunisation uptake for the elderly and the uptake of breast and cervical cancer screenings or to increase the local rate of domiciliary care. In this case, differently from pay participation, GPs' compensation is not related to the number of patients for whom the GP is responsible, but to the number of activities the physician is involved in. For this reason, the latter mechanism introduces looser incentives with respect to the previous one, also because of the lack of a credible monitoring of the GPs extent of participation.

Modelling issues, data and results

We use multilevel modelling to assess the joint influence on avoidable hospitalizations of a set of characteristics measured at different layers. Since data clustered within the same hierarchical level are likely to be correlated, standard regression techniques would produce too small standard errors, whereas multilevel techniques overcome the problem by analysing variability at each level separately. Multilevel modelling provides correct standard errors and thus correct confidence intervals and significance tests. When observations are clustered into higher-level units, the observations are no longer independent (Guo & Zhao, 2000).

Our most general specification includes up to three hierarchical levels :

(1) $$\text{logit}(\pi_{ijk}) = \log\left(\frac{\pi_{ijk}}{1-\pi_{ijk}}\right) = \beta_0 + \beta_1 X_{ijk} + v_{0k} + u_{0jk} + \varepsilon_{ijk}$$

where π_{ijk} corresponds to $\Pr\left(y_{ijk} = 1 \middle| X_{ijk}, v_{0k}, u_{0jk}\right)$ and y_{ijk} is the realisation of a random variable Y_{ijk} assumed to follow a Bernoulli distribution with parameter π_{ijk}. Here, π_{ijk} represents the

probability that a patient *i* falling under the responsibility of GP *j* in district *k* is hospitalised for an avoidable admission.

The random part of the model is $v_{0k} + u_{0jk} + \varepsilon_{ijk}$,, where ε_{ijk} , u_{0jk} and v_{0k} are the random errors at level-1, level-2 and level-3 respectively. The component u_{0jk} measures the random variation of the intercept amongst GPs, while v_{0k} measures intercept random variation amongst districts. Our specification follows standard distributional assumptions according to which random components at different levels are uncorrelated and normally distributed, while non-null correlations are assumed for patients cared by the same physician or in the same district (Rasbash et al, 2000).

The estimated variance components allow to calculate the intraclass correlation coefficients (ICCs), interpreted as the fraction of total variability attributable to a particular level of care (Browne et al, 2005).

$$\rho = ICC = \frac{\text{population variance between macro - units}}{\text{total variance}} \qquad (2)$$

Larger values of ICC ($0 < ICC < 1$) are indicative of greater potential for each layer to influence the value of the dependent variable.

Separately for the two dependent variables we estimate (1) in some steps, starting with an empty one (Model 1), to understand the basic partitioning of the variability between different levels, followed by two three-level logit model where GPs are nested within districts. Multilevel analysis are performed with SAS GLIMMIX procedure (SAS Institute, 2005)), using the IGLS algorithm with pseudo-likelihood procedure (PQL) Significance is evaluated with the Wald statistic while goodness of fit is assessed using deviance (Goldstein, 2003). The study population consists of regional citizens for year 2005 identified by integrating data from multiple sources. The resulting dataset includes 2.936.834 patients, 3.229 GPs and 39 districts belonging to 11 LHAs.

Hospital discharge rates were calculated for persons over 18 years and under age 74. As first outcome measure we consider ACSCs (Model A). We used commonly accepted lists of conditions coded using the International classification of diseases (ICD-9-CM). Our list of ACSCs was defined based on existing lists, mainly those developed by Billings et al (1993) and Caminal et al. (2004). Hospitalisations were considered to be for ambulatory care sensitive conditions when any of the ICD-9-CM codes for these conditions were listed as the primary reason for the admission. Table 1 shows all ACS conditions and the associated ICD-9-CM codes. The total number of ACSCs admissions is 16.924, corresponding to the 0,6% of the regional patients. As second outcome we

consider the regional list of 27 medical DRGs (Model B) at risk of inappropriateness in primary care, showed in Table 2, as listed in the regional resolution 319/2000. The total number of inappropriate admissions is 11.552 (0,4% of the regional patients).

INSERT TABLE 1 AND TABLE 2

Table 3 presents the explanatory variables. Patient characteristics for risk adjustment include gender, age and the presence of comorbid conditions as component variables of the Charlson index (Charlson et al., 1987; Romano et al., 1993). The Charlson index is a weighted index measure of patient comorbidity, measured from the ICD-9-CM diagnostic and procedure codes available in administrative datasets according to their potential for influencing mortality. As regards the second level, we control for GP gender, age and type of practice, distinguishing with a dummy single-handed practice from medical group practice. We also control for practice location in urban areas. Examining the GPs' list, we control for its size and for its average age of patients.

INSERT TABLE 3

As for financial incentives, we distinguish pay-for-performance, pay-for-participation and pay-for-compliance schemes. The three variables are measured as share of GPs annual income. Table 4 shows the distribution of the three schemes across local areas, while Figure 1 presents the distribution among the 39 regional districts as a fraction of the GPs' annual income. The share of total income received through the three schemes varies considerably among GPs. This is due in the first place to the substantial variability in the financial size of the programs recorded across districts.

INSERT TABLE 4

INSERT FIGURE 1

As regards the third level, multilevel analysis permits to investigate local effects, even if the specific characteristics at local level are either non-measurable or non-observable. This notwithstanding, we include two explanatory variables at the district level to account for key supply side characteristics: the number of hospital beds and the district hospitalization rate.

Table 5 presents the subsequent estimations of equation (1) for the two dependent variables (Model A and Model B) we consider: the empty and the three levels logit model for districts. For each specification, we include the ICC to illustrate the basic partitioning of the variability between different levels and the measures of goodness of fit.

INSERT TABLE 5

The empty model shows that the district level accounts for the largest share of the variability. In particular, in the empty model A the ICC between districts is equal to 1,4% and between GPs 0,6%, whereas the introduction of explanatory variables reduces the residual variability between districts to 1,1%. In Model B the within group correlation for districts of the unobserved component falls from 1.1% in the "empty" model to 0.9% when patient related variables are included. For both models, the estimated variances of the districts are significant and confirm the existence of significant variability across local areas, which at the present state of the analysis is not captured by controls for patients, physicians and districts characteristics. Such variability is due to other factors that at the present state of the analysis have not been explicitly identified and which might be not entirely measurable.

Patients' characteristics emerge as the most important factors influencing both the outcomes taken into account and the coefficients that are fairly robust across specifications. Male, older patients and those reporting more comorbidities, display a higher probability of incurring in (avoidable) hospitalisations. As regards physician characteristics, in both model the average age of the list and the urban location of the practice have a negative significant impact on the two dependent variables. For Model B, younger GP working in a single handed practice show a higher probability to have their patients hospitalized in the inappropriated DRGs.

As for the main hypothesis we wanted to test, our results suggest that regional efforts to control hospital appropriateness for the 27 medical DRGs providing additional economic transfers to GPs effectively reduce the probability to incur in an avoidable admission. Both coefficients related to pay-for-performance and pay-for-compliance incentives display the expected negative sign, showing that, other things equal, the larger the share of these payments with respect to GP total revenues, the lower the probability of hospital inappropriateness. In this case, regional intervention seems to produce a sort of crowding-in effect. On the contrary, the coefficient for pay-for-participation is never significant. In this respect, one has to consider that pay-for-participation programs are usually strictly linked to specific programs for disease management such as diabetes asthma, hypertension. Consequently, their impact is probably more precisely evaluated by choosing indicators of specific health outcomes as dependent variable, rather than by taking aggregate measures as we do in this work.

In order to test this assumption, we repeat our multilevel analysis for diabetes, extracting from database a study population of type-2 diabetics identified by integrating data from multiple sources (Lippi Bruni, Ugolini & Nobilio, 2009). As outcome measure we consider among the ACSC codes

listed in Table 1 the acute complication of diabetes (comas), identifying hospital records in which ICD-9 codes 250.2 to 250.3 are documented as primary or most responsible diagnosis. Table 6 presents the explanatory variables. Patient demographics include gender, age and insulin dependence.

INSERT TABLE 6

As regards GP, we control for the same explanatory variables previously used in the general model. As for the financial dimension, we consider only the pay-for-participation incentives directly aimed at improving diabetes care, measured as share of GPs annual income. Figure 2 presents the distribution of this payment scheme among the 38 regional districts as a fraction of GPs annual income (one district was excluded as its hospitalisation rates for diabetic comas were over 10 times the regional average, probably due to a coding mistake). Finally, to account for supply side characteristics, we consider at the third level the presence of hospital diabetes specialised wards.

INSERT FIGURE 2

As expected, patients' characteristics are the most important determinants of the adverse outcome. As for the physician characteristics, younger GPs working in single handed practices in urban areas show an higher probability to have their patients hospitalized for comas. As for our main policy question, we observe a significant association between the health outcome and the economic incentives received by GPs for diabetes care, showing that, other things equal, the larger the share of diabetes-related payments with respect to GP total revenues, the lower the probability for the patients included in the list to experience the adverse event of being hospitalized for acute diabetes complications.

In general, the empirical evidence obtained here is reinforced by the fact that when one takes as reference a measure of avoidable hospitalisation widely used at the international level, but which has not been endorsed in the present institutional context, the relationship between economic incentives and avoidable hospitalisation looses significance. Two possible explanations can be put forward at this stage. First, measures of avoidable hospitalisation elaborated in a market oriented system such as the US may not capture inappropriateness of care equally well within a NHS context. Second, there could be the risk that a dysfunctional consequence such as tunnel vision may well arise as a result of performance monitoring, concentrating GPs' efforts only on areas included in the performance indicator scheme.

Conclusions

In this paper we investigate the impact on hospital appropriateness of the introduction of economic incentives in Regional and Local Health Authority contracts for primary care in the Italian region Emilia-Romagna in the year 2005, distinguishing pay-for-performance schemes from pay-for-participation and pay-for-compliance programs. We test alternatively as dependent variables two different measures of avoidable admissions. The first outcome measure is based on the international epidemiological literature where the rate of preventable hospitalizations is measured by ACSCs, while the second is a list of 27 medical DRGs that Emilia-Romagna regards as at risk of organizational inappropriateness of primary care and that are being monitored for many years.

The comparison of intraclass correlation across different specifications confirms the importance of data clustering at the geographical level. Patients' characteristics emerge clearly as the most important factors influencing both the outcomes considered and all coefficients that are fairly robust across specifications. As regards physician characteristics for the 27 medical DRGs, younger GPs working in urban areas and in single handed practices show a higher probability to have their patients hospitalized in the inappropriated DRGs.

The most relevant policy issue addressed in the paper concerns the impact of financial incentives aimed at improving hospital appropriateness. Our preliminary results suggest that the regional efforts to control hospital appropriateness for the 27 medical DRGs providing additional economic transfers to GPs effectively reduce the probability to incur in an avoidable admission. Both coefficients related to pay-for-performance and pay-for-compliance incentives display the expected negative sign, showing that, other things equal, the larger the share of these payments with respect to GP total revenues, the lower the probability of inappropriate referral to hospital care. On the contrary, the coefficient for pay-for-participation is never significant. This may be due to the fact that such payment scheme is used for the management of specific disease such as diabetes, whose impact is more precisely evaluated by choosing as dependent variable indicators that are disease specific. In our study, regional efforts to influence GP's appropriateness modifying their prescriptions habits seem to produce a sort of crowding-in effect if we consider the group of medical DRGs targeted by the regional performance indicators. Such effect is not observed using measures of avoidable hospitalisation elaborated and put in action in different contexts.

As for the policy implications, a final note of caution must be raised, as financial incentives programs may not be fully exogenous. In principle, one might argue that in the areas where GPs had

independently developed a more direct involvement in contracting, this may have also translated into a greater propensity among GPs to agree on incentive mechanisms. Even if not much is known of the details of the bargaining process between LHAs, districts and GPs, anecdotal evidence suggests that at least the frame of the local contract reflects more the priorities set by the managing board of the LHAs. If this is the case, endogeneity is probably not such a serious problem in practice. Unfortunately, this hypothesis is not empirically testable given the cross sectional structure of our dataset, that does not allow to record how the probability incidence of the adverse outcome evolves over time with changes in the size of the financial incentives. Therefore, at this level of the analysis we can outline a positive statistical association between ad hoc transfers to GPs and hospital appropriateness, while, as for the possibility to draw more conclusive policy implications, substantial improvements could be obtained with the availability of longitudinal data that would provide a more clear-cut identification of causal relationships.

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Table 1: Ambulatory Care Sensitive Condition ICD-9-CM Codes

Angina	411.1, 411.8, 413. Excludes cases with procedure codes [01-86.99]
Asthma	493
Bacterial pneumonia	481, 482.2, 482.3, 482.9, 483, 485, 486. Excludes cases with secondary diagnosis of sickle cell [282.6].
Cellulites	681, 682, 683, 686. Excludes cases with any procedure codes except 860 where it is the only procedure
Chronic obstructive pulmonary disease	491, 492, 494, 496, 466.0
Congestive heart failure	428, 402.01, 402.11, 402.91, 518.4
Dehydration - volume depletion	276.5
Diabetes	250.1, 250.2, 250.3, 250.8, 250.9, 250.0, 251
Gangrene	785.4
Gastroenteritis	558.9
Grand mal status and other epileptic convulsions	345, 780.3
Hypertension	401.0, 401.9, 402.00, 402.10, 402.90. Excludes cases with procedures 36.01, 36.02, 36.05, 36.1, 37.5, 37.7.
Hypoglycemia	251.2
Hypokalemia	276.8
Immunization-related and preventable conditions	032, 033, 037, 045, 055, 072, 320.0, 390, 391
Kidney/urinary infection	590, 599.0, 599.9
Pelvic inflammatory disease	614 (Excludes 68.3-68.8)
Peptic ulcer	[531, 532, 533]
Pulmonary tuberculosis and other tuberculosis	011, 012-018
Pyelonephritis	590
Ruptured appendix	540.0, 540.1
Severe ear, nose, and throat infections	382, 462, 463, 464, 465, 472.1
Skin grafts with cellulitis	DRG 263, DRG 264

Table 2: 27 medical DRGs at risk of inappropriateness in primary care

014 INTRACRANIAL HEMORRHAGE OR CEREBRAL INFARCTION
019 CRANIAL & PERIPHERAL NERVE DISORDERS W/O CC
025 SEIZURE & HEADACHE AGE >17 W/O CC
065 DYSEQUILIBRIUM
088 CHRONIC OBSTRUCTIVE PULMONARY DISEASE
089 SIMPLE PNEUMONIA & PLEURISY AGE >17 W CC
090 SIMPLE PNEUMONIA & PLEURISY AGE >17 W/O CC
091 SIMPLE PNEUMONIA & PLEURISY AGE 0-17
127 HEART FAILURE & SHOCK
131 PERIPHERAL VASCULAR DISORDERS W/O CC
133 ATHEROSCLEROSIS W/O CC
134 HYPERTENSION
142 SYNCOPE & COLLAPSE W/O CC
182 ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS AGE >17 W CC
183 ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS AGE >17 W/O CC
184 ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS AGE 0-17
208 DISORDERS OF THE BILIARY TRACT W/O CC
243 MEDICAL BACK PROBLEMS
245 BONE DISEASES & SPECIFIC ARTHROPATHIES W/O CC
256 OTHER MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE DIAGNOSES
294 DIABETES AGE >35
324 URINARY STONES W/O CC
395 RED BLOOD CELL DISORDERS AGE >17
426 DEPRESSIVE NEUROSES
427 NEUROSES EXCEPT DEPRESSIVE
429 ORGANIC DISTURBANCES & MENTAL RETARDATION
467 OTHER FACTORS INFLUENCING HEALTH STATUS

Table 3: Explanatory variable definitions. Patient and GP characteristics, year 2005

Explanatory variable	*Coding*	*Mean/ Proportion*	*Standard deviation*	*Min*	*Max*
Patient level (n=2936384)					
Patient gender	male=1	49.7			
Patient age	continuos	46.4	12.8	18	74
Charlson index	continuos	0.1	1.1	0	50
Physician level (n=3229)					
GP gender	male=1	72.1			
GP age	continuos	52.0	5.4	72	32
Practice location urban	(if yes=1)	94.5			
Single handed practice	(if yes=1)	44.7			
Pay-for-performance	continuos (% annual income)	0,4	1.4	0.0	39.6
Pay-for-participation	continuos (% annual income)	5.4	4.4	0.0	56.8
Pay-for-compliance	continuos (% annual income)	0.1	0.4	0.0	7.6
List size per GP	continuos	1071.0	510.4	1	2521
List average age	continuos	50.0	5.9	14	77
District (n=39)					
District total bed	continuos	544.7	768.6	18	4290
Hospitalization rate	continuos (% population)	19.4	9	4.8	33.5

Table 4: Economic incentives distribution. Local Health Authorities**,** amounts in Euro, year 2005

		Pay- for-performance					**Pay-for-participation**					**Pay-for-compliance**				
LHA	GP	% GP	MIN	MAX	MEAN	STD	% GP	MIN	MAX	MEAN	STD	% GP	MIN	MAX	MEAN	STD
1	211	82%	0	4222	1977	1300	98%	0	49214	7755	6498	8%	0	3966	119	525
2	306	2%	0	4662	69	545	99%	0	12273	2264	2151	34%	0	3769	130	321
3	345	15%	0	3532	185	566	100%	0	21505	6781	2993	12%	0	8652	157	940
4	516	0%	0	878	3	55	98%	0	30333	6248	5118	10%	0	2066	96	334
5	639	83%	0	21780	628	1662	99%	0	16586	4331	3305	3%	0	5440	22	234
6	97	46%	0	5319	805	1636	100%	80	17287	3907	3417	5%	0	3130	120	580
7	297	0%	0	0	0	0	99%	0	26063	8038	4976	6%	0	176	6	28
8	294	11%	0	2436	47	197	99%	0	10964	2626	1516	55%	0	3906	204	420
9	148	0%	0	0	0	0	99%	0	30659	4289	4529	14%	0	1352	54	193
10	150	0%	0	0	0	0	97%	0	10705	3095	2051	13%	0	1963	109	313
11	226	0%	0	0	0	0	97%	0	11169	2364	1871	6%	0	1555	30	146

Figure 1. Economic incentives in % GP annual income. Districts, year 2005

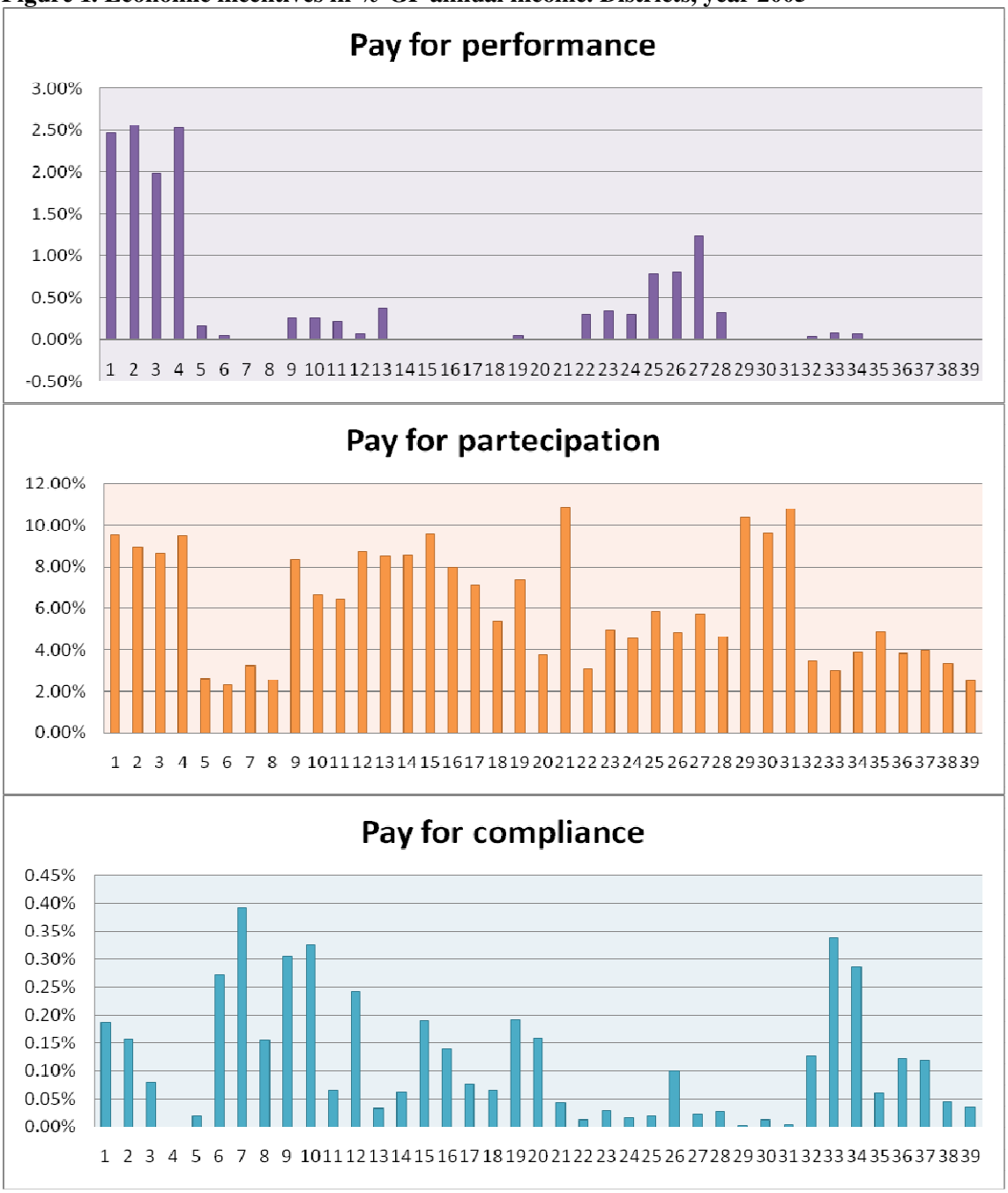

Table 5. GP and patient factors predicting an avoidable hospital admission, year 2005.

	MODEL A – ACSCs						**MODEL B – 27 DRGs**					
	Empty model			**Three level**			**Empty model**			**Three level**		
Explanatory variables	*Coefficient*	*SE*	*p >*	*Coefficient*	*SE*	*p >*	*Coefficient*	*SE*	*p >*	*Coefficient*	*SE*	*p >*
FIXED EFFECTS												
Constant	-5.145	(0.036)	***	-7.219	(0.173)	***	-5.534	(0.036)	***	-7.084	(0.174)	***
Patient level												
Patient gender				-0.399	(0.016)	***				-0.108	(0.019)	***
Patient age				0.062	(0.001)	***				0.049	(0.001)	***
Charlson index				0.004	(0.000)	***				0.003	(0.000)	***
Physician level												
GP gender				-0.002	(0.021)					0.014	(0.024)	
GP age				-0.003	(0.002)					-0.006	(0.002)	***
List per GP				2.80E-05	(2.10E-05)					1.80E-05	(2.50E-05)	
List average age				-0.017	(0.003)	***				-0.011	(0.003)	***
Single handed practice				-0.002	(0.017)					0.039	(0.017)	**
Practice location urban				-0.197	(0.045)	***				-0.232	(0.041)	***
Pay-for-performance				-0.003	(0.010)					-0.022	(0.011)	**
Pay-for-participation				0.000	(0.003)					0.004	(0.003)	
Pay-for-compliance				-0.014	(0.020)					-0.039	(0.024)	*
District area level												
Hospitalization rate				0.004	(0.004)					0.003	(0.001)	
District total beds				-1.17E-06	(4.20E-05)					-2.72E-06	(9.10E-06)	
RANDOM EFFECTS												
Level 2 - σ^2 (u_{0jk})	0.019	0.005	***	0.019	(0.005)	***	0.021	(0.007)	***	0.020	(0.007)	***
Level 3 - σ^2 (v_{0k})	0.048	0.012	***	0.037	(0.009)	***	0.036	(0.010)	***	0.029	(0.009)	***
ρ GP	0.006			0.006			0.006			0.006		
ρ districts	0.014			0.011			0.011			0.009		
Deviance [-2ln(L)]	23960851			23960418			23547982			23960851		

**** p-value ≤ 0.01 ** p-value ≤ 0.05 * p-value ≤ 0.10

Table 6: Explanatory variable definitions for Diabetes. Patient and GP characteristics, year 2005

Explanatory variable	*Coding*	*Mean/ Proportion*	*Standard deviation*	*Min*	*Max*
Patient level (n=164574)					
Patient gender	male=1	50.3			
Patient age	continuos	67.9	12.833	35	107
No insulin dependence	(if yes=1)	15.6			
Physician level (n=2938)					
GP gender	male=1	74.2			
GP age	continuos	50.8	5.539	35	71
Practice type	single-handed	31.4			
Practice location urban	(if yes=1)	94.2			
Postgraduate qualification	(if yes=1)	5.1			
Pay-for-participation	continuos (% annual income)	0.2	0.718	- 0.006	8.841
Diabetic list size per GP	continuos	56.8	20.354	4	129
List average age	continuos	50.8	5.533	35	71
District (n=38)					
Hospital beds in endocrinology	continuos	15.7	9.888	2	28

Figure 2. Pay-for-participation incentives for diabetes in % GP annual income. Districts, year 2005

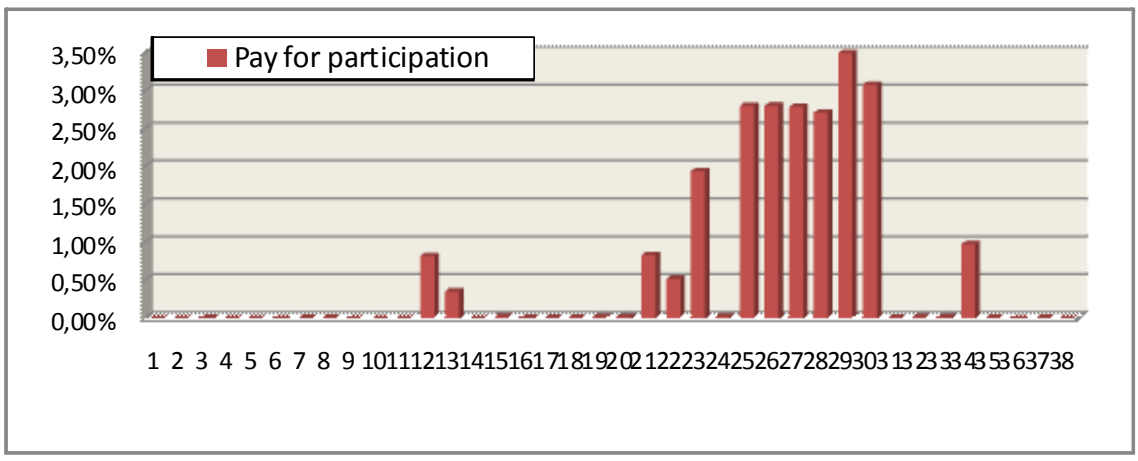

Table 7. Diabetes: GP and patient factors predicting an avoidable hospital admission, year 2005.

	MODEL A – DIABETES		
	Three level		
Explanatory variables	*Coefficient*	*SE*	*p >*
FIXED EFFECTS			
Constant	-6.473	1.065	***
Patient level			
Patient gender	0.017	0.003	***
Patient age	0.239	0.070	***
No insulin dependence	-1.232	0.070	***
Physician level			
GP gender	0.005	0.006	
GP age	-0.165	0.089	*
Single handed practice	0.126	0.076	*
Practice location urban	-0.315	0.127	***
List size	-6.00E-05	1.11E-04	
List average age	0.009	0.015	
Pay-for-participation	-0.045	0.025	**
District area level			
Hospital beds in endocrinology	0.006	0.004	
RANDOM EFFECTS			
Level 2 - σ^2 (u_{0jk})	1.27E-20		
Level 3 - σ^2 (v_{0k})	0.118		
ρ GP	3.73E-21		
ρ districts	0.035		
Deviance [-2ln(L)]	1356843		

**** p-value ≤ 0.01 ** p-value ≤ 0.05 * p-value ≤ 0.10