On the use of Disease Staging for clinical management: analysis of untimely admissions in the Abruzzo Region, Italy

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Abstract

Background and aims. The process of decentralization which recently occurred within the Italian National Health Service has transferred substantial responsibility and authority for health care administration to the individual regions. The project is aimed at developing regional benchmarks that can be used as a part of an ongoing system for analysis of resource use and quality of care in the Abruzzo Region of Italy.
Methods. All 286 924 hospital admissions for the year 2001 in the region were analysed. Three diseases were chosen for in-depth review: diabetes mellitus; cholecystitis/cholelithiasis; and bacterial pneumonia. There were a total of 9391 admissions for these diagnoses. Severity, length of hospital stay and hospital mortality were analysed using Disease Staging methodology. In addition, the timeliness of hospitalisation was assessed by grouping admissions in three categories: premature or medically unnecessary, timely and late.
Results. The rate of medically unnecessary admissions for diabetes mellitus was 72% throughout the region, and the percentage of late hospitalisations for cholelithiasis/cholecystitis was 43%. For both diseases, there were significant variations across Local Health Units in the proportion of late and early admissions. The rate of timely hospitalisations for bacterial pneumonia was higher than 86%.
Conclusion. The analysis of discharge abstract data using Disease Staging revealed that in the Abruzzo region there are problems of inappropriate hospital admission, both early and late, for all diseases examined excepted bacterial pneumonia. Data confirmed the validity of Disease Staging to compare the performance of diverse hospitals in terms of length of stay and in-hospital mortality.

Key words: health care management, disease staging, timeliness, hospitalisations, Italy

Introduction

The process of decentralization which recently occurred within the Italian National Health Service has transferred substantial responsibility and authority for health care administration to the individual regions, which are now facing the difficult challenge of choosing the most suitable reimbursement methods as well as the best tools for monitoring costs and quality of care provided in their territories.[1-3]

The Abruzzo Region is located in central Italy and has approximately one million residents. As in the majority of Italian Regions, the health care system of Abruzzo is characterized by a strong presence of public hospitals and a smaller number of private clinics.[4] However, the private sector is financed for the most part by the regional public government through various forms of agreement. With one exception,[5] no quality measurement programs have been performed in this region. In addition, no methodology aimed at supporting clinical management has been implemented.

The present research was aimed at developing regional benchmarks that can be used as a part of an ongoing system for analysis of resource use and quality of care in Abruzzo. In particular, the study focused on outcomes that are well-recognized "priorities" in Italy, such as hospital mortality, medically unnecessary or untimely hospitalisations and admissions with longer than necessary stays. Operationally, this analysis has been based on the "Disease Staging" concept[6,7] and used case and severity-adjusted clinical quality measures to evaluate the overall performance of the region as well as making comparisons among Local Health Units (LHUs). The Disease Staging methodology was considered the most suitable for the Abruzzo Region for several reasons including, time and funding considerations, it has already been

validated in several projects in Italy,[8-11] it is already known and accepted as a clinically based system by practicing physicians.

Methods

Sample and data sources

All hospital admissions for the fiscal year 2001 in the Abruzzo Region of Italy (in a total of 40 hospitals) were analysed in order to select the final sample, which was restricted to those patients who had one of the following as main diagnosis: diabetes mellitus, cholelithiasis/cholecystitis, and bacterial pneumonia. These diagnoses were identified by the Disease Staging software on the basis of ICD-9-CM codes contained in patient discharge abstract data (Schede di Dimissione Ospedaliera – SDO).[12] The three conditions were chosen because they have high prevalence, involve different settings of care, and timeliness is critical in order to avoid serious complications.

Outcomes and Disease Staging criteria

Using Disease Staging methodology to control for disease and stage of severity, the average length of stay and in-hospital mortality ratios were computed for each hospital and LHU. In addition, the timeliness of hospitalisation was analysed by grouping admissions in three categories: premature or medically unnecessary, timely and late. A database of one million discharges from a large Italian region was used for comparative purposes, and the criteria adopted to assign the stages of severity as well as the timeliness categories are available elsewhere in detail.[13] Briefly, Disease Staging logic defines levels of biological severity for specific diseases, where severity is considered as the risk of organ failure or death. The classification is therefore based on the severity of the patho-physiological manifestations of the disease. Although there are several exceptions in the definition of the Staging criteria, most of the diseases begin at stage 1 (no complications) and continue through stage 2 (local complications) and stage 3 (multiple sites involved or systemic complications), up to stage 4 (death). An early hospitalisation requires a level of medical care that can be provided in an outpatient setting and is thus considered inappropriate, leading to higher costs than necessary. When the admission is timely, the patient was admitted at the earliest detectable stage at which the likelihood of disease progression may be significantly decreased through use of resources available only in a hospital setting; or the patient had another condition unrelated to the main diagnosis that made ambulatory treatment inappropriate; or patient compliance rendered inpatient care necessary. Finally, a hospitalisation was late if the patient had complications that could be prevented with an earlier admission. An example of the first type is a patient with an elevated blood sugar but no other complications (Stage 1 Diabetes Mellitus). Appendicitis without rupture is an example of a timely admission (Stage 1 Appendicitis), while empyema in a patient with bacterial pneumonia is an example of late admission (Stage 2-3).

Statistical analysis

Patients who died in the hospital were excluded from the analysis of length of stay patterns to avoid skewing the results. Length of stay was trimmed in the analysis, excluding outliers and 0-1 day admissions. Bivariate χ^2, t-test statistics and ANOVA were used to test the statistical significance of observed differences across groups for categorical and continuous variables, respectively.[14] Statistical significance was defined as a two-sided p-value < 0.05. All analyses were performed using STATA statistical software, version 8.2 (College Station, Texas, USA, Stata Corporation, 2003).

Results

There were 286 924 admissions to the hospitals of Abruzzo in 2001. Of these, a total of 9391 patients were admitted because of one of the three diagnoses under study: diabetes mellitus (n = 2562), cholelithiasis/cholecystitis (n = 4328), and bacterial pneumonia (n = 2501).

The percentage of early, timely and late hospitalisations for each disease is reported in Table 1. Throughout the region, the rates of medically unnecessary admissions were particularly high for diabetes mellitus (72%). By contrast, more than 40%

Table 1. Percentage of timely, early and late ordinary admissions by disease, at a regional level.

	Timeliness of hospitalisation			
Diseases	**Early**	**Timely**	**Late**	**Total**
Diabetes	72.1 (1846)	2.2 (57)	25.7 (659)	100 (2562)
Cholecystitis/cholelithiasis	16.0 (693)	41.2 (1781)	42.8 (1854)	100 (4328)
Bacterial Pneumonia	NA (-)	86.5 (2163)	13.5 (338)	100 (2501)

Data are reported as % (numbers). NA=not applicable.

Table 2. Length of stay and in-hospital mortality of ordinary admissions by disease and timeliness, at a regional level.

Diseases and timeliness	LOS [a]	Mortality [b]
Diabetes		
Early	8.2	0.27
Timely	10.1	0
Late	10.8	5.3
Cholecystitis/cholelithiasis without surgery		
Early	5.8	0.14
Timely	7.9	0
Late	7.4	1.97
Cholecystitis/cholelithiasis with laparoscopic cholecystectomy	*	**
Timely	5.9	0.08
Late	6.3	0.24
Cholecystitis/cholelithiasis with open cholecystectomy or other surgery	§	
Timely	10.6	0.68
Late	12.4	0.99
Bacterial Pneumonia		
Timely	11.1	3.2
Late	14.5	13.0

[a] LOS = Observed trimmed average length of stay, in days. Differences in length of stay are statistically significant (all $p < 0.01$ – ANOVA or t-test statistics), with one exception (* - $p = 0.58$). [b] In-hospital mortality as %. Differences in mortality rates are statistically significant (all $p < 0.01$ – χ^2 test), with two exceptions (** - $p = 0.39$; § - $p = 0.6$).

Table 3. Percentage of timely, early and late ordinary admissions for cholelithiasis/ cholecystitis by Local Health Unit (LHU).

	Timeliness of hospitalisation		
Local Health Unit	**Early**	**Timely**	**Late**
A	13.8 (141)	35.1 (358)	51.0 (520)
B	14.8 (118)	26.4 (211)	58.8 (470)
C	18.9 (118)	53.0 (331)	28.0 (175)
D	19.5 (127)	42.4 (276)	38.1 (248)
E	18.5 (68)	46.5 (171)	35.0 (129)
F	14.0 (121)	50.1 (434)	36.0 (312)
Overall Region	16.0 (693)	41.2 (1781)	42.8 (1854)

Data are reported as % (numbers). Differences across LHUs are statistically significant ($p < 0.001$ – χ^2 test).

of cholecystitis/cholelithiasis patients were hospitalised late.The rate of timely admissions was extremely low for diabetes (less than 3%); low for cholecystitis/cholelithiasis (41%); but high for bacterial pneumonia (more than 86%).

Table 2 shows the length of stay and in-hospital mortality by disease and timeliness pattern, at a regional level. Although a few differences were not significant, late hospitalisations were consistently longer and had higher mortality rates for all conditions than timely or early admissions.

Comparisons were made among LHUs regarding the proportion of untimely admissions for all diseases. Rates of late hospitalisations for cholelithiasis/cholecystitis ranged from 28% in the local health unit C, up to 59% in LHU-B (Table 3). Significant variations across LHUs were observed as well in the proportion of late and early hospitalisations for diabetes mellitus. In LHU-C 84% of admissions for diabetes were early (Table 4). There was less variation observed in the proportion of timely and late hospitalisations for bacterial pneumonia by LHU within the region: the percentage of timely admissions ranged from 82% in LHU-E to 89% in LHU-C (Table 5).

Discussion

The main aim of the project was to initiate a quality measurement program in the Abruzzo Region, Italy, that could support the regional health care system for the clinical management and administration activities. Priority areas for increasing the efficiency of patient care provided in the region were identified through comparisons of patterns of care for patients with common medical and surgical conditions by different hospitals.The data demonstrated that in the region there are problems of inappropriate hospital admission, both early as well as late, for the diseases examined. While hospitalisations for bacterial

Table 4. Percentage of timely, early and late ordinary admissions for diabetes by Local Health Unit (LHU).

	Timeliness of hospitalisation		
Local Health Unit	**Early**	**Timely**	**Late**
A	69.0 (407)	1.2 (7)	29.8 (176)
B	67.2 (423)	2.1 (13)	30.7 (193)
C	84.2 (363)	0.70 (3)	15.1 (65)
D	72.2 (307)	4.2 (18)	23.5 (100)
E	77.6 (128)	2.4 (4)	20.0 (33)
F	67.7 (218)	3.7 (12)	28.6 (92)
Overall Region	72.1 (1846)	2.2 (57)	25.7 (659)

Data are reported as % (numbers). Differences across LHUs are statistically significant ($p < 0.001 - \chi^2$ test).

Table 5. Percentage of timely and late ordinary admissions for bacterial pneumonia by Local Health Unit (LHU).

	Timeliness of hospitalisation	
Local Health Unit	**Timely**	**Late**
A	88.1 (490)	11.9 (66)
B	83.2 (301)	16.8 (61)
C	89.2 (289)	10.8 (35)
D	86.0 (459)	14.0 (75)
E	81.9 (176)	18.1 (39)
F	87.8 (448)	12.2 (62)
Overall Region	86.5 (2163)	13.5 (338)

Data are reported as % (numbers). Differences across LHUs are statistically significant ($p = 0.04 - \chi^2$ test).

pneumonia were timely in more than 86% of cases, the care of cholecystitis/cholelithiasis needs particular attention, since more than 42% of the admissions were late.

Delayed admissions identify major health management challenges since they have important economical and quality care implications.A patient hospitalised in a timely manner consumes significantly fewer resources and has better outcomes in terms of morbidity and mortality than a patient admitted later than desirable in the disease process.[7,10] This was also evident in this study (Table 2). Therefore, even though it is clear that not all late hospitalisations are preventable, hospitalising even a small proportion of these patients at an earlier stage might yield substantial cost savings, as well as a potential reduction in morbidity and mortality.

Certainly, in order to reduce the proportion of late admissions, further knowledge of the reasons for the delay is needed. In fact, late hospitalisations may depend on a number of factors, which include the competence of the professionals, the ability or willingness of the patients to enter the system at the right time, the quality of the infrastructure available in the region, and, of course, the reward system including regulations. As regards to the influence of the infrastructure, the analysis stratified by local health unit and by single hospital, revealing which are the less efficient locations, permits the linkage between structural features and health care outcomes. Significant variation in mortality rates and length of stay found across providers for both diabetes and cholelithiasis/cholecystitis, after adjusting for severity. Percentages of early and late admissions differed as well throughout the region. Further analysis will be made collecting hospitals characteristics, then examining their relationship with the above outcomes of care. Data at a hospital level are also of crucial importance in terms of clinical management, as they indicate which structures require priority intervention.

Premature hospitalisations are also a relevant managerial issue, since costs associated with inpatient stay are generally higher than those of an outpatient visit.[15-16] Furthermore, the incidence of important adverse events associated with inpatient stay might be reduced as well. In the study, 1846 admissions for diabetes and 693 for cholecystitis/cholelithiasis were inappropriate, with average lengths of stay of, was respectively, 8.2 and 5.8 days. This turns out as a total of more than 19 000 days of hospital stay that could have been avoided, if these less severe patients had been treated in an outpatient setting.

The project strongly relies on the use of Disease Staging software and logic. Since conclusions on health care outcomes based on unadjusted indices are justifiably going to evoke strong resistance from physicians and other health professionals,[6,17] the adjustment for clinical

severity provided by staging represented the best option. Although using hospital discharge abstract data has potential problems associated with the quality of ICD-9-CM coding, manual sampling of data from more than 250 000 patient records was not feasible. In addition, these are the same data used for hospital financing and provide the advantage of enabling large scale studies. Finally, the analysis of lengths of stay, mortality rates and DRG tariffs by stage of severity confirmed the consistency of the staging analysis, as all of these outcomes were substantially worsening in more advanced stages (data not shown).

It is possible that, using the staging as well as other methodologies to adjust for the severity of the case-mix, some of the complications used to control for severity are the results of bad care rather than pre-existing conditions.[17] However, these should reasonably represent a small proportion of cases, and more detailed review of potential problems could address this issue. Disease Staging has repeatedly proved its validity and reliability in a number of studies with such data.[7-9]

Other well-known limitations have to be taken into consideration in interpreting the findings on in-hospital mortality: the small number of events in some strata of the analysis and the fact that people who have been discharged and died outside the hospital are not captured by the present records. It is worth noting, however, that discharging terminal patients was surely uncommon in the socio-cultural context of Abruzzo Region in year 2001.

This study used a mixture of process (timeliness) and outcomes measures (mortality) to evaluate the quality of care. Indeed, this was appropriate since, looking only at outcome data impairs the determination of causes.[18] Of course, having a timely admission is not always indicative of receiving high quality inpatient care. Future studies could include both measures before, during, and after the hospital stay.

The last step of the project will be aimed at informing the local medical and administration staff of the results. In order to assist the executives in interpreting the findings and planning potential changes, a report including main results and comparing patterns of each hospital to those observed for all hospitals in the region will be sent to the medical directors and chairmen of the medical and surgical directorates of the 15 largest hospitals.

In conclusion, the analysis of discharge abstract data using Disease Staging revealed that in the Abruzzo Region there are problems of inappropriate hospital admission, both early and late, for all of the diseases examined excepted for bacterial pneumonia. Data confirmed the validity of Disease Staging to compare the performance of diverse hospitals in terms of length of stay and in-hospital mortality. However, specifically designed further studies are warranted in order to clarify which are the most pertanent reasons for inappropriate as well as late hospitalisations.

References

1) Jommi C, Cantu E,Anessi-Pessina E. New funding arrangements in the Italian National Health Service. Int J Health Plann Manage 2001;16:347-68.
2) Fattore, G. Cost containment and reforms in the Italian National Health Service. In Mossialos, E. and Le Grand, J. (Eds): Health care and cost containment in the European Union. Aldershot, UK: Ashgate, 1999.
3) Taroni, F. Devolving responsibility for funding and delivering health care in Italy. Euro Observer 2000;2:1-2. available at: http://www.euro.who.int/document/OBS/EuroObserver2_1.pdf
4) Maio V, Manzoli L.The Italian Health Care System:W.H.O. ranking versus public perception. P&T, Pharmacy and Therapeutics 2002;27:301-8. Avaailable at: http://www.ptcommunity.com/ptjournal/fulltext/27/6/PTJ2706301.pdf
5) Carnessale G, Staniscia T, Matarrese D, et al. Appropriateness of hospitalization in the teaching hospital of Chieti using the P.R.U.O. approach. Ann Ig 2003;15:117-22.
6) Gonnella JS, Hornbrook MC, Louis DZ. Staging of disease: a case-mix measurement. JAMA 1984;251:637-44.
7) Gonnella JS, Louis DZ, Zeleznik C,Turner BJ.The problem of late hospitalizations: a quality and cost issue.Acad Med 1990;65:314-9.
8) Louis DZ, Yuen EJ, Braga M, et al. Impact of a DRG-based hospital financing system on quality and outcomes of care in Italy. Health Serv Res 1999;34:405-15.
9) Yuen EJ, Taroni F, Louis DZ. The Italian case-mix project: repeated hospitalizations and the quality of care. Clin Perform Qual Health Care 1994;2:129-34.
10) Cicchetti A, Macinati MS, Marchetti M, et al. Severity of illness and organizational variables – drivers of performance in clinical departments in a teaching hospital in Italy. Proceedings of the 16th International PCS/E Working Conference, Groningen, The Netherlands, 2000.
11) Taroni F, Repetto F, Louis DZ, Moro ML, Yuen EJ, Gonnella JS.. Variation in hospital use and avoidable patient morbidity. J Health Serv Res Policy. 1997;2:217-22.
12) Nonis M, Corvino G, Fortino A. La scheda di dimissione ospedaliera. Roma: Il Pensiero Scientifico Editore, 1999.
13) Gonnella JS, Louis DZ, Gozum ME, Callahan CA, Barnes CA, editors. Clinical Criteria for Disease Staging, 5th Edition. Ann Arbor, Michigan: Thomson Medstat, 2003.
14) Pagano M, Gauvreau K. Principles of Biostatistics, 2nd Ed. Belmont, CA: Wadsworth, Inc., 2000.
15) Siu AL, Sonnenberg FA, Manning WG, et al. Inappropriate use of hospitals in a randomized trial of health insurance N Engl J Med. 1986;315:1259-66.
16) Carey K, Stefos T. Measuring inpatient and outpatient costs: a cost-function approach. Health Care Financ Rev 1992;14:115-24.
17) Iezzoni LI. Risk adjustment for measuring health care outcomes,3rd ed. Chicago: Health Administration Press, 2003:17-32.
18) Palmer H. Using health outcomes data to compare plans, networks and providers. Int J Qual Health Care 1998;10:477-83.