Introduction

Hospital readmissions represent an increasing, significant and highly expensive cost for National Health Services. A hospital readmission is defined as an admission to an acute care hospital within 30 days of discharge from the same or another acute care hospital.[1]

In the United States, preventable hospital readmissions were estimated to contribute over $25 billion to wasteful health care spending annually.[2] Previous research has shown that among the nine million hospitalizations of Medicare patients per year[3], almost one fifth of patients are readmitted within a month of discharge and many more return to the emergency room.[4]

Rehospitalization shortly after discharge is increasingly recognized as a marker of inpatient quality of care[5], but has been observed that current hospital readmission measures are inadequate for reporting hospital quality. Readmissions are in fact influenced by multiple sources of variation, such as mix of patients served or bias in the performance measure, and true differences in quality of care are often a much smaller source of this variation.[6]

Geographic variation is also closely related to hospital readmissions, depending on the chances to access the specific medical care for a disease[7], and also disparate physician and family expectations may affect both the decision-making process and patients' care outcomes resulting in repeated hospitalizations.[8]

Zapatero et al.[9] showed that readmissions within 30 days to Spanish Internal Medicine departments are prevalent as 12.4%, and key factors that predicted subsequent admission included male sex, length of stay, comorbidities, and some clinical conditions. In Italy, the overall hospital readmission prevalence was 10.2%, with a total of 43.7% judged to be potentially avoidable.[10]

In countries with a rapidly ageing population, increasing life expectancy, rising chronic disease burden and decreasing working population are all factors that contribute to straining the finite healthcare resource further.[11,12] Higher comorbidity rate[13,14] and multidrug resistant infections[15] have been shown to be associated with an increased risk of readmission.

There is consensus that in order to reduce avoidable hospital readmissions, it is crucial to properly identify the patients at highest risk, and main modifiable risk factors[16].

Thus, assessing the role of comorbidities in determining repeated readmissions in real-life is crucial, but there is a need for more data. Additional research on understanding this complex phenomenon, and to find effective interventions applicable to acute inpatient populations aimed to reduce potentially avoidable readmissions, are strongly needed.

Internal Medicine and Geriatric Unit, [9,17] are notoriously very affected by this problem; therefore, they can provide updated real-life data to understand the evolution of the phenomenon over time.

In this short paper, we retrospectively analyzed all patients who underwent readmissions to our Italian Internal Medicine ward during a year, assessing the main demographic characteristics of patients, their comorbidities and mortality, and performing an analysis depending by the DRGs distribution, comparing them with controls who underwent only one hospitalization episode.

Materials and Methods

A retrospective case-control study was conducted between January 1 and December 31, 2018 at the Internal Medicine Unit of the Hospital of Pontedera (Pisa, Italy), assessing the characteristics of all consecutive patients who required hospitalization. Among these, we compared the patients who underwent hospital readmissions (cases) with those patients who required only one hospitalization during the year and were discharged alive (controls).

In particular, the main demographic characteristics of all patients, their comorbidities and mortality, the home-patient setting and social problems previously emerged, were carefully

assessed. All the patients received a comprehensive assessment within 24 hours from admission, administered by trained clinicians.

The 30-days re-admissions were retrospectively analyzed crossing the data collected from the Hospital Discharge Register containing the Diagnosis-Related Group (DRG) codes. All data were retrieved matching data from our electronic health record (Sistema C7, Fondazione Gabriele Monasterio, CNR Pisa) with our DRG software system (ADT, Engineering Group, Roma)[18]. Among all the readmissions, the most relevant and frequent DRG was included in the study. Moreover, we performed an analysis depending by the DRGs distribution among cases and controls.

All DRGs were grouped into clusters, according to the main organ involvement or pathogenetic mechanism.[19] Table 1S shows the DRG clustering and the average weight of each major diagnostic category observed in the study.

Statistical Analysis

Continuous variables were defined as mean ± standard deviation; categorical variables were given as percentage. The independent sample t test was used for the continuous variables and the chi-square test for categorical variables. A logistic regression analysis was also performed. Significance was inferred for a p value <0.05. Statistical analysis was performed using Microsoft Excel version 2016.

Results

In the 12-months study period a total of 3012 patients (mean age 76.8±14.3 years; range 17-102, 46.7% males) were admitted to our Internal Medicine Unit.

Cases, defined as patients who underwent hospital readmissions, were 426 (14.1%), their mean age was 79.7±11.9 years (range 23-100), and 45.8% were males.

Controls were 420 (13.9%), their mean age was 75.9±14.7 years (range 22-99), 44.3% were males.

Among the 426 cases, the number of readmissions ranged from a minimum of 2 to a maximum of 8 in the study period (Table 1).

Table 2 shows the results of the univariate analysis. The mean age was higher in the case group (79.7 vs 75.9 years), while no significant difference was found between groups for the sex.

Cases showed a higher prevalence of cerebrovascular disease (77.2% vs 48.1%), cognitive decline (51.8% vs 26.9%), congestive heart failure (47.6% vs 20.2%), chronic kidney disease (31.7% vs 13.1%), chronic obstructive pulmonary disease (23.0% vs 14.5%), skin ulcers (45.1% vs 17.6%) than controls. No significant difference was found regarding diabetes and active cancer.

We assessed also the presence of skin ulcers, showing a significantly higher proportion among patients requiring readmissions (45.1% vs 17.6%).

Regarding patient setting, provenience from home-based health care settings was significantly higher in controls group (91.9% vs 84.7%), while previous extended care was significantly more frequent in patients who required readmissions (12.7% vs 6.2%). Previously identified social problems were instead similarly distributed between the two groups.

The report of diagnosis related groups (DRGs) in both groups is listed in table 3. The average length of stay (ALOS) was similar (9.2±7.1 days in cases vs 10.0±7.0 days in controls), such as the DRG average weight.

Main characteristics and DRGs of dead patients are reported in Table 4. DRGs analysis showed a higher proportion of Infectious disease (24.4% vs 15.0%) and Kidneys-Urinary Tract-Reproductive organs related diseases (9.6% vs 5.0%) in the case group than in controls. Conversely, Central Nervous System disease (22.4% vs 10.6%) and Gastrointestinal-liver related diseases (10.5% vs 6.6%) were significantly higher in the controls group. All other DRGs did not show significant changes in distribution between cases and controls.

The absolute mortality rate was significantly higher in cases than in controls (53.5% vs 37.4%), such as the occurrence of death within 30-days from last admission (38.2% vs 12.1%). The average time between admission and death was significantly longer in controls group (57.7 versus 31.0 days). The mean age of patients who died was similar in cases and controls.

At the DRGs analysis, Sepsis (31.6% vs 19.1%), Pneumonia (17.1% vs 7.6%) and Kidney Failure (9.6% vs 3.8%) were significantly more frequently in cases compared to controls the main cause of mortality. For controls, a significantly higher proportion of Active Cancers (25.5% vs 17.1%) was observed. Among dead patients, DRG average weight was significantly higher in controls than in cases (1.20 vs 1.14)

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Discussion

In our study, cases who underwent hospital readmissions within 30 days were 14.1% of total of 3012 patients hospitalized during a year in an Internal Medicine ward, a percentage similar to that of 12.4% reported by Zapatero et al.[6] in Spanish Internal Medicine departments. Unlike these authors, we have not found male sex and length of stay as significant key factors predicting readmissions. A reduction of length of stay, especially in elderly subjects, increased early rehospitalization rates also in the work of Fabbian et al.[20] conducted among patients admitted to the department of medicine of a general hospital in Italy. In the Fabbian' study the most frequent causes of rehospitalization were cardiovascular disease in 29.3% and pulmonary disease in 29.7% of cases; also in our cohort, considering distribution among cases, Lung disease was the DRG most frequently reported in 32.6%, while Cardiovascular disease was less often codified (4.5%).

Our study shows a high complexity of patients who underwent repeated hospital readmissions, since they are older and very often affected by chronic diseases.

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Considering the baseline characteristics of patients, we have not observed statistical differences for diabetes and active cancer. Regarding diabetes, this could be related to the high and increasing prevalence of this condition in general population for whom has been there for some time an extensive and structured health assistance network in the outpatient setting, while regarding active cancer an efficient model of management (the Home-based health care was even significantly more frequent in controls) and awareness of the poor prognosis associated with the disease, could explain why the number of readmissions is not higher in this category of very fragile patients. Thereafter, patients who underwent readmissions were significantly more affected by chronic diseases that can progress to a fast worsening or exacerbations, such as Chronic Kidney Disease and Chronic obstructive pulmonary disease.

Cognitive decline was significantly more represented (twice fold) in patients who required readmissions, confirming what is already known from the current literature.[21]

In this study, the presence of skin ulcers were specifically assessed as key factors determining the readmission risk, showing a significant impact as a major determinant. The chronic course of ulcers needs the creation of a structured territorial network capable of managing them, otherwise they lead to continuous re-hospitalization both directly and indirectly for local and systemic complications, such as infections and sepsis. The role of skin ulcers deserves more attention than what has been given so far: in a recent multinational study, the combinations of diseases categories that were most strongly associated with readmissions, were chronic kidney disease with liver disease or chronic skin ulcers.[22]

Regarding to patients setting provenience, we observed that the majority of patients in both groups were previously treated in a Home-based health care, with a weak higher significance for controls group. Patients who required readmissions, more often came from nursing homes or similar health-assisted settings (extended care), suggesting that the out-of-hospital system is evidently not yet completely ready to take charge of a large number of patients with chronic situations. A recent meta-analysis showed that at 1 month from discharge, the continuity of care interventions was associated with lower readmission rates, preventing short-term hospital readmission in older people with chronic diseases, but without any conclusive evidence about the effectiveness aiming to reduce long-term readmission.[23] Many episodes of readmission can be ultimately related to social environment, poor familiar assistance and inadequate follow-up program, anyway the suitability of early rehospitalization as a correct target for good medical practice is to date debated.[24]

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Social problems, often related to poor economic conditions, were low and equally distributed in both groups: in our study, they did not represent a relevant factor for recurrent hospitalizations.
Apart the lung disease-related DRG, representing the most represented in both groups, Infectious disease was the first DRG in the readmission group (24.4%), significantly higher than controls (15.0%). It is well known that readmissions after a sepsis episode are very common and costly, and that the majority of readmissions were associated with infectious aetiologies, thus efforts are needed to clarify all the determinants of readmission after a first sepsis episode and develop strategies in terms of quality of care and care transitions to prevent this outcome.[25]
Central nervous system DRGs were more frequent (twice) in controls group: a possible explanation is that, being control patients relatively less affected by chronic comorbidities and being the assignment of DRG mainly based on the highest resources consumption, these DRGs can emerge even if they are less remunerative than those related to lung diseases and sepsis, for whom there is a stronger relationship with the revolving group.
Absolute mortality rate (53.5%) was higher, as expected, compared with other data in literature regarding patients with readmissions,[26] but once again, we have to underline that sepsis was our first DRG in dead cases, followed by pneumonia and kidney failure: our data is in line with the high mortality related to sepsis when occurring in elderly patients.[27]
Cancer-related DRGs were instead significantly more frequent in dead controls: this is interesting, suggesting that, since controls are less affected by chronic illnesses, their DRG really emerges as cancer. Anyway, DRG average weight was then significantly higher in control group, since cancer, and in particular haematological malignancies, have a highly remunerative DRG.
No significant differences were observed for the other death-related DRGs between groups.
We noted that the high percentage of revolving patients with any skin ulcer (45.1%) did not have an adequate correspondence in DRG (Skin Wound 1.4%): this could be explained both by a tendency to underestimate the importance of ulcers remuneration, and by the fact that skin ulcers in such patients frequently represent the source of sepsis, which is subsequently encoded in the main DRG.
We believe that focusing on the problem of ulcers could represent a strength of our study.
A main limitation of this study is that, for the retrospective design, only the association between factors, not causation, can be determined. Moreover, since DRGs are operator-encoded procedures, there could be some bias and thus a variability in the results, but the operator who encoded DRG in our Department was a very expert and trained clinician.

Conclusions

In conclusion, our study confirms that readmissions to Internal Medicine Departments are frequent and mainly related to the severity of chronic diseases affecting the patients, especially when able to sudden worsening towards an acute phase. Sepsis was the most relevant condition

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associated with readmissions, leading to a very high mortality rate, and this could indirectly reflect the global burden of antibiotic resistance: Italy is currently one of the most interested country in Europe.[28] Skin ulcers are present in about half of the patients who are early readmitted, but they were coded as DRG only in an absolute minority, so more accurate coding is needed. Although further investigation is warranted in order to clarify these complex relationships, preventing sepsis and investing resources in chronic diseases assistance represent a key challenge for the future.

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