IDENTIFYING FACTORS ASSOCIATED WITH HOSPITAL READMISSIONS AND IN-HOSPITAL DEATHS IN STROKE PATIENTS
An exploratory analysis of a single hospital in Ravenna

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INTRODUCTION

Readmission and death after stroke is frequent, but limited data are available in Italy. This study aimed at assessing frequencies, causes, and factors associated with readmissions and in-hospital deaths within 1-year after admission from stroke hospitalization. The study was designed as an exploratory retrospective analysis conducted at the Hospital Stroke Unit providing care for acute stroke patients located in Ravenna, Italy. The study included 250 patients admitted with stroke between 1st January and 31th December 2015. Data was collected on up to 1-year follow up or death (if within follow-up period).

METHODS

Patient-level data checked by hospital personnel allowed for inclusion of CT-confirmed stroke cases only. For each patient, data collection sources were clinical operative registries, administrative electronic charts and hospital discharge letters concerning stroke-related admissions within 12 months from index hospitalization. Logistic regression analyses were performed to estimate odds ratio comparing patients with and without risk factors, and adjusting for age, gender and post-stroke disability level (only for readmissions analyses). OLS regression analyses investigated associations between hospital costs (measured as in-patient length of stay) and patients' risk factors.

Table 1. Association between poor outcome (disability or death at index hospitalization) and patients' characteristics, logistic regression

	Odds Ratio	Std. Err.	[CI]
Age	1.029*	0.012	[1.005;1.053]
Female	0.905	0.274	[0.500;1.638]
Hemorrhagic stroke	9.533**	3.927	[4.252;21.374]
Hypertension	0.883	0.294	[0.460;1.700]
Hypercholesterolemia	0.288**	0.122	[0.126;0.661]
Diabetes Mellitus	1.547	0.601	[0.723;3.311]
Cigarette Smoking	3.592**	1.691	[1.428;9.039]
Atrial Fibrillation	2.533**	0.891	[1.272;5.047]

CI (confidence interval) set at 95%.

Stars indicate a p-value statistically significant at 95% (*) or 99% (**)

Table 2. Summary of results from multivariate regression analyses

	Probability of Death		**Probability of Poor Outcome**	**Probability of Readmission**		**Costs** (measured by length of stay)		
	Index Admission	1-year follow-up	Index Admission	Total	Unplan.	Index Admission	1-year follow-up (Total)	1-year follow-up (Unplan.)
Hypertension	↓ **	↓ **	↓	↓	↓	↑ **	↑	↑ **
Hypercholesterolemia	↓	↓	↓ **	↑	↑	↓	↑	↑
Diabete	↓	↑	↑	↑	↑	↑	↓	↓
Smoking	-	↓	↑ **	↓	↑	↑ *	↓	↓
Atrial Fibrillation	↑ *	↑ **	↑ **	↓	↑	↑	↑	↑ *

The symbol ↑ indicates a positive relationship, while the symbol ↓ indicates a negative relationship between each covariate and the outcomes.

Symbols in bold indicate consistent results in the same category (represented by first headings)

Stars indicate a p-value statistically significant at 95% (*) or 99% (**) confidence level.

RESULTS

In this study, 29.2% of patients were readmitted at least once during follow-up. Comorbid conditions were prevalent in stroke patients.

Table 1 shows the association between patients' risk factors and the **probability of a poor outcome** (disability and/or death, odds ratio). Hypertension and hypercholesterolemia had a significantly lowering impact on the probability of a poor outcome after a stroke; atrial fibrillation had a significantly positive association with the probability of a poor outcome (disability and/or in-hospital death).

Table 2 summarizes the results of multivariate regression analyses investigating the association between comorbidities and the outcomes: death, poor outcome (disability or death) at index hospitalization, readmissions and readmission costs. Results are presented for total stroke-related admissions and for unplanned readmissions only (excluding rehabilitation).

Diabetes and hypercholesterolemia showed a marked positive association with **probability of readmission**, while hypertension showed a marked negative association; however, results were not significant.

Overall, **probability of death** was positively associated with atrial fibrillation; this association was statistically significant. Moreover, mortality showed a negative significant association with hypertension.

Both hypertension and atrial fibrillation were found to be significantly associated with **hospital costs** expressed by length-of-stay; namely, hypertension and atrial fibrillation more than doubled hospital costs for total unplanned readmissions.

The results for the impact of smoking addiction on the analyzed outcomes were mixed.

CONCLUSION

Identifying patients' features associated with hospital readmissions and in-hospital deaths can provide crucial information in the development of intervention programs to reduce unnecessary readmission and avoidable deaths, and thus improve hospital quality and ultimately reduce hospital costs. A significant association was found between risk factors and death rates; however, this study did not identify predictors of probability of readmission after stroke.

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