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The impact factors on the hospital high length of stay outliers

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Abstract

The growing financial problems of healthcare institutions contribute to the search for methods of properly distributing and clearly justifying resources. One of these is detecting the length of stay outliers (LOS) accounting for an important share of hospital costs. The purpose of this study is to analyze the factors facilitating identification of hospital LOS outliers. A total of 4570 patients were analyzed. To select the outliers, I used the inter-quartile method, using the median and the inter-quartile distance. The LOS outliers comprised 5,4% of the study sample and accounted for almost 15% of total hospital costs and 25% of total inpatient days. The median and range of the total costs for LOS outliers were (€) 3145,26 (1930,54-4670,88). The status of an LOS outlier was associated with age and type of admission. Eighty three percent of the LOS were admitted to the hospital in an acute way. Most of the LOS outliers (56% of all LOS outliers) were younger than the mean for the study population. There was no significant correlation between the reason for discharge, the type of department or the gender and being an LOS outlier. It is concluded that identifying the LOS outliers can contribute to better knowledge of hospital costs and help the management of these institutions control those costs.

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1. Introduction

Concern over the rising resources consumed by health care costs has become widespread in many countries in recent years. The growing year to year financial problems of health care sector entities have contributed to the

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intensive search for the causes of this situation and the solutions that could change it (Russell-Weisz et al., 2004; Freitas et al., 2012; Russell-Weisz et al., 2000).

One of the ways to do this is to improve the system of managing the costs in hospitals. To do this, hospitals have attempted to develop a systematic approach for identifying the exceptional episodes connected with extreme lengths of stay. Moreover, the length of stay is an important measure of resource utilization. For this reason, analyzing the LOS outliers is fundamental for the management and financing of hospitals. Many hospitals have used or still use length of stay for managing the efficiency of resource utilization

Prospective payment schemes in health care often include special funding for cost outliers. In order to share the risk of an extremely long stay of a patient in hospital, in many health care financial systems high LOS outliers receive additional payments for each day above the high outlier threshold (Antioch et al., 2007; Russell-Weisz et al., 2004).The separate reimbursement of outliers is important for protecting both patients and managers (Freitas et al., 2012). For example, in Australia funding for an admitted patient is based on standard prices for central scaled episodes and, where applicable, separate payments for additional costs are incurred with respect to exceptional episodes (Russell-Weisz et al., 2000). Furthermore, since the introduction in 2008 of diagnosis-related groups (DRGs), Polish hospitals are paid for patients with respect to the length of stay (LOS) by DRG.

Therefore, the purpose of this study is to analyze the factors facilitating the identification of hospital LOS outliers using available administrative data.

2. Material and methods

The main source of data for this analysis were the administrative databases of the hospital in Olsztyn. The hospital in Olsztyn deals with diagnostics, therapy, care, specialist advice, education, prevention and health promotion. Between January and June 2013 there were 5367 patients admitted to Departments of Cardiology, Laryngology, Ophtalmology, Nephrology and ICU, Gastroenterology, Orthopaedics, Surgery, Neursurgery, Gynaecology, Endocrinology and Diabetology, Haematology.

We reviewed all of the patients that were admitted to the hospital departments between January and June 2013, expect newborns (N=462). Some of the patient were excluded from the analysis because of the missing data (n=335). Finally in this study we have analyzed 4570 patients. Cost analysis were done retrospectively using accountancy data from the hospital and statistical data from the hospital reports to National Health Fund. The linkage between two databases was carried out using Access Microsoft. Patient costs were tracked in three categories. Direct costs (DC), like drugs, medical procedures and diagnostic tests that were identified directly with the care of individual patients. Indirect costs (IC) were administration costs and costs assigned to the specific hospital department but not with particular patient. The indirect costs were aggregated and assigned to individual patients on a LOS basis. The sum of DC and IC constituted total costs (TC) .

To select the outliers we used inter-quartile method, using the median and the inter-quartile distance. To select high outliers the 75th percentile + 1,5*inter-quartile range was used. To identify the low outliers we used the 25th percentile – 1,5* inter-quartile range. Because the rule 25th percentile – 1,5* inter-quartile range detected a negative trim-point in further analysis we considered only high LOS outliers.

To evaluate the factors that influence the patient being LOS outlier we considered: age, gender, type of admission, reason of discharging, type of department. Statistical analyses were carried out using StatSoft, Inc. (2011). STATISTICA, version 10. The analysis of contingency tables was executed with Pearsons's 2-test and with the Mann-Whitney test on continuous variables (age). Univariate analysis and multivariable logistic regression were used in the study.

3. Results

3.1. Description of the sample

On the studied population, the mean patient age was 56,54 years; men comprised 43% of the study sample. The mean and standard deviation of LOS were 5,39 days and 6,65 days, respectively.

Table 1. Predictive factors for total LOS outliers (LOS O) and inliers (LOS I).

Characteristics	LOS O N=250	LOS I N=4320
Age (years) mean s.d.[16]	51,88 (20,11)	56,81 (18,06)
Age n (%)		
<56	139 (55,60)	1892 (43,80)
>56	111 (44,40)	2428 (56,20)
p	<0.001	
Gender n (%)		
Female	154 (62)	2437 (56)
Male	96 (38)	1883 (44)
p	NS	
LOS (years) mean s.d.	25,03 (15,14)	4,25 (3,14)
LOS n (%)		
<Mean	0 (0)	2696 (62)
>Mean	250 (100)	1624 (38)
p	<0.001	
Type of admission n (%)		
Planned	42 (17)	2340 (54)
Unplanned	208 (83)	1980 (46)
p	<0.001	
Reason for discharge n (%)		
Finished therapeutic process	161 (64)	2860 (66)
Directed to further treatment	78 (31)	1365 (32)
Death	11 (4)	95 (2)
p	NS	
Department n (%)		
Surgical	198 (79,20)	3247 (75,16)
Nonsurgical	52 (20,8)	1073 (24,84)
p	NS	

Most of the patients were admitted to the hospital with a planned admission (52,12%) and were discharged from the hospital within 4 days (58,99%). The main reason for discharging patients was finishing the therapeutic process (66,11%), while 31,58% of the patients were directed to further treatment. The majority of patients had been cured in the surgical departments (75,38%). The median and standard deviation for the total costs, direct costs and indirect costs of hospitalization were: (€) 895,20 (458,91-1633,75); (€)344,02 (130,30-883,20); and (€)380,44 (193,40-774,30), respectively.

Of the studied population, 250 patients were identified as LOS outliers who comprised 5,4% of the study sample. Ninety five percent of the study population were LOS inliers. All of the LOS outliers were in hospital longer than 5 days (the mean LOS for the study sample). Among the LOS inliers, this percentage was 38. The mean age of LOS outliers was 51,88 (20,11) and the mean length of stay was 25,03 (15,14). Mainly, the LOS outliers were female (62%). Eighty three percent of the LOS outliers were admitted to the hospital as unplanned patients and 64% of them had finished the therapeutic process positively. Almost 80% of the LOS outliers were surgical patients (Table 1).

Since the profiles of LOS outliers differed in a statistically significant way from LOS inliers with regards to gender and type of admission, we estimated the probability of a patient being an LOS outlier by multivariate analysis (Table 2).

Table 2. Logistic regression model: estimated probability of a patient being LOS outlier.

Variables	Adjusted OR	(IC*95%)	p-Value
Type of admission			
Planned	1		
Unplanned	5,67	(4,02-7,98)	<0,001
Age	0,99	(0,98-0,99)	=0,011

In multivariate analysis, we discovered a significant influence with regard to age and type of admission on being

an LOS outlier. The probability of being an LOS outlier increased more than 5 times for patients being admitted unplanned. Each additional year of patient age decreased the probability of being an LOS outlier almost one time. LOS was excluded in estimating the probability of a patient being an LOS outlier because of the strong correlation between these two variables.

Table 3. Median and range of total hospital costs, direct costs and indirect costs for LOS outliers (LOS O) and inliers (LOS I).

Costs **(€)** median [range]	LOS O	LOS I
Total costs	3145,26 [1930,54-4670,88]	845,35 [443,88-1483,32]
Direct costs	635,25 [275,76-1882,10]	330,29 [123,26-845,08]
Indirect costs	1987,81 [1439,15-2823,14]	357,05 [182,48-673,20]

The median total cost, direct costs and indirect costs for LOS outliers was (€)3145,26, (€)635,25 and (€)1987,81, respectively. For LOS inliers these costs were (€) 845,35, (€) 330,29 and (€) 357,05, respectively. The median total cost of LOS outliers was almost four times (3.72) higher than inliers. In the case of indirect costs, the difference was even greater (5.57). The smallest difference between the costs of LOS outliers and inliers was found to be direct costs (1.92). In the study sample, LOS outliers accounted for 15,5% of total hospital costs, 9,8% of direct costs, 21,8% of indirect costs and for 25.41% of inpatient days.

4. Conclusion

The study of LOS outliers is important mainly because they are closely related to hospital costs. Moreover, they represent an important proportion in hospital inpatient days. In our study, LOS outliers comprised 5,4 percent of the study sample. Other studies reported LOS outliers from 2.0 to 2.4 percent (Lagoe et al., 2012). This can be associated with different methods of LOS outlier selection. In our study, we found that LOS outliers accounted for 15,5% of total hospital costs, 9,8% of direct costs, and 21,8% of indirect costs. It confirms that a small percentage of patients represent an important proportion of hospital costs. However, this proportion can be dependent on the accounting system of the hospital. For example, the larger share of direct costs assigned directly to patients, the greater the relationship between LOS outliers and indirect costs.

In our study, we confirmed that age and type of admission were significantly associated with the LOS outliers. Patients with unplanned admission had almost a six time higher risk to become LOS outliers than planned admission patients. Freits et. al (2012) reported that emergency surgical admissions have significantly more outliers than planned surgical admissions. Omachonou et. al (2004) also reported that emergency admission patients tend to stay for longer periods of time than non-emergency patients.

We confirmed that patient age has a visible influence on LOS outliers. In our study, the mean of LOS outlier age was lower than the mean of age of LOS inliers. This finding does not support the study of Omachonu (2004), which concluded that patients' age was found to be significant in only one of five developed predictive models for the LOS. In the study by Morrison et al. (1985), the older patients were associated with a higher proportion of outliers. In our study this relation was the opposite. This can be associated with the profile of a hospital in which the Gynecology Department plays an important role. In such an instance, patients will mainly be young pregnant women, and this will have an influence on the hospital case mix. This can also be associated with the finding that the LOS outliers in our study were mainly female. This finding does not support the study of Omachonu (2004).

As high LOS outliers represent an important share of the total inpatient days, this data should be important information for managers and health care payers. Because the time of arrival and hospital location of LOS outliers are difficult to predict and a small proportion of such episodes can have a considerable impact on the financial stability of a particular hospital, an additional pool of money should be established to better manage the risk associated with these exceptional episodes.

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