ESTABLISHING HOSPITAL PERFORMANCE INDICATORS THROUGH THE ANALYSIS OF TECHNICAL PLATEAU CONSUMPTIONS

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Abstract: *The research aims at identifying some indicators for the management and operation of the hospital, following the application of sustainable management, corresponding to an effective financing of medical practice in hospitals. It aims to achieve a new perspective on the use of these indicators as indicators of hospital management, together with the health indicators. Given the complexity of hospital care involving many types of resources and services provided and the high percentage of indirect costs which lead to imprecise estimates of the cost / patient and hospital cost per day, we chose to calculate these administrative indicators that would allow to identify those ineffective administrative activities over which hospital management could pay more attention with a view to take measures to improve and streamline them.*

Rezumat: *Cercetarea are ca scop identificarea unor indicatori de administrare şi funcţionare a spitalului, ca urmare a aplicării unui management durabil, corespunzător unei finanţări eficiente a practicii medicale în spitale. Se urmăreşte realizarea unei noi perspective privind utilizarea acestor indicatori ca indicatori ai managementului spitalicesc, alături de indicatorii medicali. Dată fiind complexitatea proceselor de îngrijire din spital care implică multe tipuri de resurse şi de servicii furnizate, precum şi procentul mare de cheltuieli indirecte care conduc la estimări imprecise ale costului/pacient şi pe zi spitalizare, am optat la calcularea acestor indicatori administrativi, care ar putea permite identificarea acelor activităţi administrative ineficiente, asupra cărora managementul spitalului şi-ar putea îndrepta mai mult atenţia, în vederea luării măsurilor de îmbunătăţire şi eficientizare a acestora.*

The performance indicators of a hospital should reflect the following:

    1. Quality of healthcare and efficiently in terms of economics.

It is reflected in the number of cases resolved through continuous hospitalization and through day hospital, the index of disease complexity, reduced average length of stay up to the standard limit at which a patient can be solved in ambulatory, decrease of mortality index, increased use of beds above the national average indicator, maintaining control of nosocomial infections, decreased hospital costs / patient and per hospital day, increase the comfort of patients (accommodation, safety and security conditions in the hospital).

    2. Increasing technical efficiency through the appropriate use of resources and eliminating dissipation.

Traditionally, the role of maintenance has always been relative, but by careful monitoring of consumption, maintenance is intuitive and can be planned and scheduled in a sustainable strategic management.

This has the advantage that maintenance can be planned and budgeted instead be considered only when it becomes absolutely necessary. Such practices often result in delaying or ignoring maintenance.

To improve public hospital management, it is recommended hence to calculate the costs and the cost per patient and per hospital day, not only medically, but also in terms of maintenance and operating costs (technical plateau administrative expenses) by a set of indicators to complement the current range of management indicators.

    3. Keeping technical plateau costs under control.

In this context, within the database, a first set of data is the consumption indicators necessary to the technical plateau management of a hospital, namely: hospital costs, hospital costs per patient / per bed and the hospital costs per bed / day of hospitalization. Thus, the database monitored the following indicators: annual energy consumption, annual energy consumption / patient, annual energy consumption / day of hospitalization, annual gas consumption, annual consumption of gas / patient, annual consumption of gas / day of hospitalization, annual water consumption, annual water consumption / patient, annual consumption of water / day of hospitalization.

A second set of data is the repair and investment indicators also necessary to the technical plateau management of a hospital i.e. current repairing and building and equipment investments.

The third set of data is the hospital performance indicators that reflect the quality of care and the efficiency in economic terms: number of cases resolved through continuous hospitalization and through day hospital - total discharges, disease complexity index, average length of stay, utilization of beds.

The data series used in the analysis are time series covering the period 2000-2012, during which the indicators needed to the technical plateau management of a hospital were monitored (annual consumption of gas, electricity, water, annual

consumption of gas, electricity, water per patient and hospital day).

The software used for data processing and statistical analysis was SPSS 19.

Directions for consumption efficiency

For a hospital, efficiency is designed to reduce costs, increase outpatient services, increasing the weight of day hospitalization and decreasing the length of stay, obtaining higher incomes, using best practice guidelines for diagnosis and treatment.

In this context, we recall the management efforts on: re-evaluating the methodology for calculating the costs of hospitalization for each patient, case-based financing adjustment for the cases with extreme hospitalization length, the use of comparative reports to improve wards management in close correlation with the incomes and expenses for each doctor in the hospital, standardization in certain limits of consumption behaviour, information and consultation of physicians in establishing economic strategies and the short, medium and long term development.

Figure no. 1. a) Evolution in time of gas, energy, water consumption; consumption of gas/patient; b) consumption of gas/hospitalization day
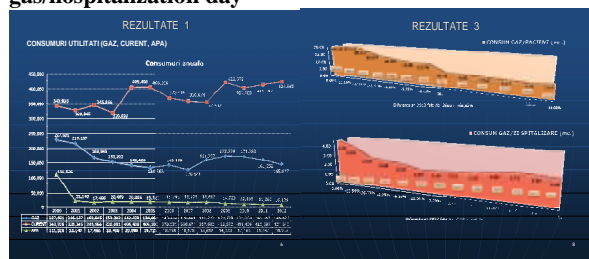
a)   b)

In terms of total gas consumption, there is a downward trend, which has been approximated by the method of least squares, with a trend model type: power and exponential. In the case of the power trend model type, the estimated regression equation is the following:

$$y = 228582,15 * x^{-0,25}$$

and in the case of the exponential trend model, the estimated regression equation form is as follows:

$$y = 201894,40 * \exp(-0,04 * x)$$

For both trend models, the report of determination is high ($R^2 = 0.923$ for power trend and $R^2 = 0.750$ for the exponential trend), the confidence interval does not cover the value of 0 for the constant, neither for the parameter, test associated significance value test for the two trend model coefficients model (for both models) being significant (sig = 0.000 <0.05), therefore, from these considerations, we can choose either of the two trend models to be representative of the development trend of gas consumption, but due to the higher determination report, we will consider representative the power trend model type.

By analyzing the evolution in time of gas consumption / patient indicator, there is a downward trend bearing the form of the estimated regression equation (R2 = 0.903):

$$y = 30,68 * \exp(-0,11 * x)$$

In case of changes in consumption of gas / day of hospitalization, there is an oscillating trend, decreasing in 2000-2005, followed by an increase in 2006-2010, and then again a decrease in 2011 and 2012, an average consumption gas / day of hospitalization being M = 3.14 (SD = .70).

In conclusion, there is an exponentially decreasing trend, both in the total gas consumption and a significant decrease in gas consumption / patient, thanks to investments in

the buildings, especially the modernization of the heating system by installing new and performant plants, achieving thermal insulation of the building walls.

Figure no. 2. a) Evolution in time of energy consumption/patient, per hospitalization day b) consumption of water/ patient, per hospitalization day
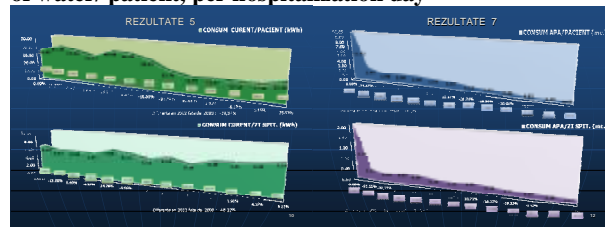
a)   b)

In terms of total energy consumption, there is an oscillating trend, with decreases in 2004-2008, followed by increases in the period 2008-2012, an average energy consumption being M = 377.369 (SD = 37.189). If, however, we consider the evolution in time of the energy consumption/ patient indicator, there is a decrease from 2004 to 2011 and then a slight increase in 2012, but well below the 2000 level, the average energy consumption / patient being M = 33.32 (SD = 11.22)

In the case of the evolution of energy consumption / hospital day, there is a steady trend during 2000-2007, followed by an increase, reaching in 2012 an increase of about two units compared to 2006, an average energy consumption / day of hospitalization being M = 7.21 (SD = .96).

In conclusion, although there is an increasing trend of total energy consumption, there is yet a significant decrease in energy consumption / patient, thanks to investments in the buildings.

In the case of the total water consumption, there is a downward trend with a significant decrease of the value from 2001 than the one in 2000, followed that from 2001 to 2012, the decrease be much slower. The evolution of values is given by the exponential regression equation form:

$$y = 42683 * \exp(-0,11 * x)$$

We also analyzed the trend but only for the period 2001-2012, where we found a certain homogenization of values. In this case, using a linear trend model, the estimated regression equation is:

$$y = -1018 * x + 23752$$

The same downward trend is observed in the case of water consumption / patient and the consumption of water / day hospitalization. In this case, the regression equation is

$$y = -0.23 * x + 3.15$$ for water consumption/patient

respectively,

$$y = -0.01 * x + 0.43$$ for water consumption/day of hospitalization

In conclusion, there is a decreasing trend of total water consumption, water consumption / patient, water consumption / day of hospitalization due to investments in the buildings.

Following these upgrades, there has been reached a total water consumption, on average of M = 17131 (SD = 4126), water consumption / patient on average of M = 1.59 (SD = 0.90), consumption of water / day hospital an average of M = 0.31 (SD = 0.07)

The costs spent for electricity, gas and water are presented in an uptrend, primarily due to the ongoing inflation from year to year.

There is an upward growth during the years 2000 - 2004, 2007 - 2009 and 2011 - 2012 for repairs and investments in buildings and a slight decrease in the period 2005 - 2006 due

to: fluctuations in the approved budget in this regard, hospital revenue from the contracts with the Regional Health Insurance House assigned to current repairs, legislative interdictions to use the hospital own funds on investments, fluctuation of the hospital development fund from year to year, accomplished from revenue balance at the end of the budget year.

Conclusions:

Time series analysis aims to understand and shape the mechanism of generating terms series by: identifying the nature of the phenomenon, identifying the pattern (shape) of the time series, interpreting and integrating in classes of other already known patterns, the obtained model being then useful for generating predictions, prediction being an inference of a variable outside the observed period.

This research aims to improve the quality of hospital management through: lower costs per patient and per day of hospitalization due to reduced consumption of the administrative technical plateau, identification of consumption standards for gas, electricity and water as a means of internal control, which should permanently be taken into consideration by the administrative management of the hospital, the promotion of an open organizational culture through effective communication and teamwork.

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