Outcomes analysis of hospital management model in restricted budget conditions

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ABSTRACT

Facing conditions of market economy and financial crisis, the head of any healthcare facility has to take adequate decisions about the cost-effective functioning of the hospital. Along with cost reduction, the main problem is how to maintain a high level of health services. The aim of our study was to analyse the quality of healthcare services after the implementation of control over expenses due to a reduction in the budgetary resources in Military Medical Academy (MMA, Sofia, Bulgaria). Data from the hospital information system and the Financial Department about the incomes and expenditures for patient treatment were used. We conducted a retrospective study on the main components of clinical indicators in 2013 to reveal the main problems in the hospital management. In 2014, control was imposed on the use of the most expensive medicines and consumables. Comparative analysis was made of the results of the medical services in MMA for 2013 and 2014. Our results showed that despite the limited budget in MMA over the last year, the policy of control over operational costs succeeded in maintaining the quality of healthcare services. While reducing the expenses for medicines, consumables and laboratory investigations by \(\sim26\%\), some quality criteria for healthcare services were observed to be improved by \(\sim9\%\). Financial crisis and budget reduction urge healthcare economists to create adequate economical instruments to assist the normal functioning of hospital facilities. Our analysis showed that when a right policy is chosen, better results may be achieved with fewer resources.

KEYWORDS

Costs control; healthcare management; hospital costs

Introduction

Managing a hospital under conditions of financial crisis and budget cuts is a challenge for every health manager. When the resources within a hospital are limited, it is important that managers are aware of how the costs are formed and how they relate to the therapeutic activity.

Economic methods and analysis provide different options for developing effective strategies for running available resources in the most appropriate way. On the other hand, it is important to maintain the relevant level of quality of medical services. For any strategy to be successful, it is important to communicate to the whole staff: all its components, aims and expected results in detail.

Many authors voice concerns that budget cuts will decrease the quality of medical services.[1–8] They predict that when hospitals face financial pressure, it will reduce the quality of care, will limit the access to new technologies and, of course, will lead to problems with aging hospital infrastructure.[9–12]

When there are problems in the economy of the health sector, the main goal is to achieve optimal performance at minimal involvement of labour, material and financial resources. This is a challenge faced by all economists in healthcare worldwide [13,14] due to the essential impact that the economy has on healthcare.[15]. There is a large amount of accumulating evidence that the level of the economy is a key factor in the health welfare of the population.[15]

Assessment of the behaviour or welfare of individuals, companies and markets related to the use of pharmaceutical products, medical services and programmes is in the domain of health economics.[16] Most often, the focus is directed towards the costs (inputs) and results (outputs) of their use. Economic techniques include different types of analyses: cost-minimization, cost-effectiveness, cost–utility, cost–benefit, cost-of-illness, cost–consequences, as well as any other economic analytical technique which presents valuable information in making decisions about the healthcare system for the
allocation of scarce resources.\textsuperscript{[17]} Economics suggests that these different approaches provide different incentives for decision-making towards economic behaviour, with implications for efficient and equitable distribution of healthcare resources.\textsuperscript{[18]}

Based on these approaches, a study can be made from the perspective of patients, physicians, wards, hospitals, health insurance funds, government bodies, etc. This diversity of perspectives makes it rather difficult to compare different studies, since different authors approach the problems differently depending on the time period, the chosen model, the kind of costs included, etc.

The aim of our study was to analyse the quality of healthcare services after implementation of control over expenses due to a reduction in the budgetary resources in Military Medical Academy (MMA, Sofia, Bulgaria). The main question that was addressed was whether the policy of decreasing the healthcare costs influenced the health services.

**Methodology**

This study was performed from the perspective of the hospital management of MMA (Sofia, Bulgaria). It was carried out retrospectively, over the period of July—December 2013 and 2014. This limited period was chosen because a new management body of the MMA was elected in June 2014. Facing critical hospital financial conditions, they were forced to make adequate decisions aimed at immediate cost reduction.

We used reports from the financial department to determine the main sources of financing, as well as the distribution of costs. The method of the six cost blocks (Intensive Care Working Group on Costing)\textsuperscript{[19]} was used to identify individual components and their contribution to the total costs (Table 1).

Cost Block 1 (Capital equipment): all assets that were valued over 1000 BGN (1 BGN = 0.51 euro), less than 10 yr old and were expected to last at least 1 yr were identified.

Cost Block 2 (Estates): depreciation, maintenance, utilities and so on.

Cost Block 3 (Non-clinical support services): communal services.

Cost Block 4 (Clinical support services): pharmacy and dietetic services were subsequently excluded, as their contributions were both small and difficult to measure.

Cost Block 5 (Consumables): these included drugs, piped gases and disposable equipment.

Cost Block 6 (Staff costs): salaries and insurance for the staff.

All costs were divided into direct and indirect ones in order to derive their proportion. The direct cost estimates were determined using the micro-costing method, in which all relevant cost components from hospital admission to discharge of a patient were defined at the most detailed level. Direct costs included diagnostics (imaging, laboratory and other diagnostics), drugs, labour (direct patient time of medical specialists, fellows, nurses and other staff), inpatient stay (hotel and nutrition and indirect patient time of nurses) and devices. Indirect cost components included overheads and capital.\textsuperscript{[20–23]}

After MMA budget allocation analysis, a policy of reducing the cost of the main components was introduced. The initial measures were aimed at renegotiation of contracts with external service providers (building maintenance and utility services). The next steps aimed to impose control over the medicines and consumables used in the inpatient units. A wide range of economic analyses and models aimed at identifying the most costly medicines and medical consumables used were performed and a system of three-level control over their usage was introduced. The most costly medicines and consumables can only be prescribed by the hospital management; on the second level, Heads of departments and clinics are permitted to prescribe costly but more commonly used products; physicians on the third level are allowed to use the most common products. We calculated how this policy affected the cost reduction as a whole.

**Table 1.** Cost blocks and their elements.

| Capital equipment | Estates | Non-clinical support | Clinical support | Consumables | Staff |
|-------------------|---------|----------------------|------------------|-------------|-------|
| 1                 | 2       | 3                    | 4                | 5           | 6     |
| (1) Standard linear depreciation Building depreciation Administration/management Cleaning Radiology Blood, blood products Consultants |
| (2) Total maintenance Water, sewage, waste disposal, energy Maintenance engineering, decoration Other (renal, cardiology) Disposables Non-consultants |
| (3) Annual lease/hire charge Laboratory Pharmacy Dietetics |
| (4) % | | | | | |

V. VASEVA ET AL.
Hospital information system data were used to compare some quantitative and qualitative indicators of the treatment processes in the second half of 2013 and 2014. The results from the analysis were presented on a regular basis, every six months, to the whole hospital staff together with the measures, the aim and the expected results from the new policy of cost control. The purpose of these presentations was to ensure that every person involved in the treatment process is well informed about the purpose of the policy and the contribution they would have in the achieved results.

Results and discussion
MMA, Sofia, Bulgaria, is an organization with a unique structure and activity in Bulgaria. In addition to ensuring the needs of the military missions in Bulgaria and abroad, it is a hospital of national importance in cases of disaster and emergency. On the other hand, its functions also cover treatment of the civilian population under contracts with the National Health Insurance Fund of Bulgaria (NHIF). As an academy, MMA provides training of undergraduate, postgraduate, PhD students, etc. It has a very well designed Emergency Centre, Intensive Care Units and operating theatre. The most complicated clinical cases from all over the country are treated here. In a recent study performed by NHIF, this hospital ranks third in Bulgaria according to the preferences of patients and the number of patients diverted from other hospitals (Figure 1).

Budget
Since MMA is in the public sector, its budget is formed by two main sources: 54% by the Ministry of Defence (MoD) and 44% by NHIF, and only 2% come from its own income.

As a result of the economic crisis in the last five years, the governmental bodies in Bulgaria were forced to take critical measures, including budget cuts. This had a critical reflection on public hospitals and MMA was not an exception. Both its funding institutions imposed cuts on the financial resources. On the one hand, the fixed budget funding that comes from MoD was cut by 15%. On the other hand, NHIF also set a limit for the payment of diagnostic and treatment procedures. The sum of the incomes from these two main sources showed that the budget of MMA was decreased by 20% in 2014 compared to 2013. In these circumstances, the hospital management, therefore, had to decide how to cope with this problem, i.e. how to maintain a high level of medical services with reduced incomes.

Distribution of expenses
The analysis of the distribution of expenses in MMA shows that about 50% of the costs account for salaries and social insurance contributions of the staff, 21% for external services and 18% for medicines. Unfortunately, less than 2% remain for capital expenditures and general repair activities. Figure 2 illustrates the main items of the costs of MMA.

If the costs are considered in terms of direct and indirect costs for the treatment process, the direct ones (medicines, consumables, laboratory tests and staff) represent 83% of the total. Indirect costs include laundry, cleaning, security, repairs, communal services and food and account for 17%. Although the staff costs represent 50%, the hospital management did not include them in the first stage of the cost control programme. The measures covered the next two most significant costs groups: the external services and medicines, consumables and laboratory tests.

The results from the initial measures showed a decrease in the costs for external services. Following negotiations, this part of the expenses was cut by 54%. This was reflected as 21% reduction in the total hospital

Figure 1. Number of diverted patients from other hospitals (NHIF data, 2014).

Figure 2. Costs distribution.
costs. The three-level cost control over medicines and consumables gave very good results. For consumables, which are the more expensive component, this system achieved 30% cost cuts and for medicines, 20%. Both amount to 26% and present 13% of the total cost reduction (Table 2).

As an example, Figure 3 shows the impact of the programme in factual numbers regarding medicines and consumables in the most costly units at the hospital, the Department of Haematology and Oncology, which account for 16% of the total costs for medicines and consumables. The imposed control resulted in 43% cost reduction in the Oncology Unit and 23% in the Haematology Unit. The mean cost savings achieved by these two clinics are 33%. This was reflected as 16% reduction in the costs of this block.

The same procedure was applied for laboratory tests. The results are shown in Figure 4. The comparative analysis of the results for the second half of 2013 and 2014 showed that, despite the 28% increase in the number of tests carried out in 2014, a 22% cost reduction was achieved.

Taken together, the total reduction of costs (external services, medicines and consumables, laboratory tests) in 2014 was 42%, which amounted to 26% of the total hospital costs. Table 3 illustrates how the reduction of costs in each paragraph is reflected in the total cost cuts.

**Effect of cost reduction on the quality of medical services**

The next step was to analyse how the achieved reduction in the costs affected the quality of medical services. For this purpose, the most commonly used quantitative parameters were chosen. Table 4 shows a detailed comparison between the quantitative parameters regarding the numbers of treated patients in the second half of 2013 and 2014. The analysis of the clinical parameters showed that, despite the cost reduction, the number of treated patients had increased. In spite of the budget cuts and the fact that emergency care costs in Bulgaria are not covered by the NHIF, there was a considerable increase in the number of emergency patients (10% for admitted emergency and 18% for emergency outpatients). Hypothetically, if a hospital in circumstances similar to those of MMA would refuse to admit emergency patients in order to achieve better financial results, this would invariably have a negative effect on its image. Therefore, such a drastic strategy was not implemented in MMA. For example, in the early 1980s in the United States, budget cuts reflected in patient dumping from

| Table 2. Costs for medicines and medical consumables. |
|-----------------|-----------------|-----------------|
| Costs (EUR) | Second half year 2013 | Second half year 2014 | Costs saved | Costs saved (%) |
| Medicines | 3,421,544 | 2,720,604 | 700,940 | 20 |
| Consumables | 5,212,088 | 3,667,207 | 1,544,881 | 30 |
| Total sum | 8,633,632 | 6,387,811 | 2,245,821 | 26 |

| Table 3. Cost reduction in 2014 compared to 2013. |
|-----------------|-----------------|-----------------|
| Costs | Cost reduction (%) | Effect on total cost reduction (%) |
| External services | 54 | 21 |
| Medicines and consumables | 26 | 13 |
| Laboratory tests | 22 | 8 |

| Table 4. Quantitative parameters of medical services. |
|-----------------|-----------------|-----------------|
| Second half 2013 | Second half 2014 | % (2014 compared to 2013) |
| Treated inpatients (number) | 17,763 | 18,193 | +2.4 |
| Admitted patients (number) | 17,301 | 17,732 | +2.5 |
| Emergency patients (number) | 5605 | 6173 | +10.1 |
| Outpatients (number) | 69,520 | 71,068 | +2.2 |
| Emergency outpatients (number) | 29,736 | 35,176 | +18.3 |
| Average number of examinations per day | 378 | 386 | +2.1 |
| Average number of examinations per hour | 15.7 | 16.1 | +2.5 |
private into public hospitals. Although in 1986 a federal law was passed to prevent dumping, there is still evidence that some hospitals may continue to turn away patients in need of emergency care based on financial considerations.[24]

However, it should be noted that the number of patients as a quantitative parameter for evaluation of the quality of medical services has some limitations. For example, an increase in the number of patents might be related, at least in part, to a decrease in their length of stay. That is why our analysis included other additional indices, e.g. preoperative and postoperative length of stay, to give more precise assessment.

To evaluate the efficiency of the treatment process, qualitative parameters were also used. The chosen parameters indicated that there was a 9.4% improvement in the results. Table 5 shows the measures that indicate improvement in the treatment process in the second half of 2013 and 2014. The best results were observed regarding the reduction of the nosocomial infections (22.2%) and postoperative hospital stay (12.5%). The most important qualitative indicator, hospital lethality, was reduced by 5.2%. However, it is noteworthy that there was also a reduction in the length of hospital stay. This observation suggests that this parameter needs to be monitored over a longer period, as some authors point out that reduced hospital stay in some cases, e.g. psychiatric patients, may be associated with an increase in rehospitalisation.[25] On the other hand, in some cases it may be possible to both reduce the hospital stay and improve the quality of medical services (e.g. less complications) by introducing an appropriate technique, as reported, for example, for the fast-track protocol in open colonic surgery.[26] These examples illustrate that reductions in the hospital stay may be observed for different underlying reasons and may thus be associated with different effects on the quality of care depending on the hospital unit and the type of medical procedure. That is why we will continue to closely monitor the specific trends in the quantitative and qualitative parameters in future to ensure that, if necessary, adequate modifications in the cost reduction programme in MMA will be made in a timely manner.

### Table 5. Qualitative parameters of medical services.

|                          | Second half 2013 | Second half 2014 | % (2014 compared to 2013) |
|--------------------------|-----------------|-----------------|--------------------------|
| Average hospital stay (days) | 5.1             | 4.87            | -4.5                     |
| Preoperative hospital stay (days) | 4.0             | 3.9             | -2.5                     |
| Postoperative hospital stay (days) | 1.6             | 1.4             | -12.5                    |
| Nosocomial infections (%)   | 3.6             | 2.8             | -22.2                    |
| Hospital lethality (%)     | 1.54            | 1.46            | -5.2                     |

**Final remarks**

The quantitative and qualitative indicators for clinical parameters used in the present study tend to indicate that, despite the cost cuts due to the budget reduction, MMA seems to have maintained its quality of care in July—December 2013 and 2014. These initial results suggest that it is possible to direct the hospital policy towards reduction of hospital expenses if strict care is taken not to negatively affect the quality of the medical services it provides. Such delicate balance could be achieved by management of the attitudes of the treating staff on the cost—benefit ratio of patient care in general, since the costs of medical care critically depend on doctors, e.g. choice of treatment options, drugs and consumables, types of laboratory tests, etc. We suggest that this is achievable by evidence-based therapy and careful grading of the treatment priorities along with taking into account factors such as side effects and cost—benefit ratio. Multiplication of the effects of the evidence-based practice and the control of the cost—quality relationship on the management level set in our model reduces the overall direct and indirect expenses of the hospital. Despite the satisfactory results of our study, we have to take into account the previous experience reported in this area. For example, a recent study in Taiwan observed contradictory results showing the effect of reduced cost of medicines on the length of hospital stay.[27] On the other hand, some authors have examined the impact of shortened hospital stay on the increased percentage of patients' rehospitalisation.[28] Therefore, we should continue to monitor the results of the implementation of our program. It is necessary to supplement the parameters used for assessment of the quality of medical services by including new indicators, investigating the effect of different expenditure groups on patient outcomes (number of patients transferred to other hospitals, number of admitted patients without health insurance, relationship between shortened hospital stay and hospital lethality rate and number of rehospitalisations).[29]

**Limitations**

The studied indicators showed that in spite of the reduced budget available to the hospital, it succeeded in maintaining the quality of medical services by involving all medical staff in the cost reduction programme. Our study, however, has some limitations. First, it used the number of patients as a quantitative indicator of the quality of medical services, which does not, in itself, reflect other aspects, such as changes (reduction) in the length of stay. Further studies including additional indices, e.g. patient condition upon discharge, agreement
between the preliminary and the final diagnosis and number of rehospitalised patients, will be performed to more precisely evaluate all aspects of the quality of medical services in MMA, Sofia, Bulgaria, after the introduction of the cost reduction programme. Second, the study covered a very short period, the second half (July–December) of 2013 and 2014, and a longer observation will be needed to prove or disprove the conclusions inferred from this initial analysis.

### Conclusions

The results obtained using a wide range of common economic instruments showed that, when a right policy is chosen, it is possible to achieve control over results with fewer resources. The outcome analysis showed that, despite the limited budget available to MMA, Sofia, Bulgaria, in 2013 and 2014, the management of MMA succeeded in maintaining the studied quality criteria for medical services by reducing the cost for services, medicines, consumables and laboratory tests by approximately 42%. The policy of control over operating costs and involving all hospital staff in implementation of this policy allowed the hospital facilities to continue functioning normally. Finally, the studied parameters, together with additional ones, will be further monitored in future to evaluate the trends and long-term effects in view of development of a long-term strategy in accordance with the government policy and healthcare reforms.

### Disclosure statement

No potential conflict of interest was reported by the authors.

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