The effect of performance-volume limit on the DRG based acute care hospital financing in Hungary

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\begin{abstract}
\textbf{Objectives:} The aim of our paper is to analyse the effect of the so-called performance volume limit (PVL) financing method on acute hospital care.

\textbf{Data and methods:} The data were derived from the nationwide administrative dataset of the National Health Insurance Fund Administration (OEP) covering the period 2003–2008. We analysed the trends in the DRG cost-weights, number of cases, case-mix, and average length of stay. We calculated the average annual reimbursement rate per DRG cost-weight with and without the application of PVL depression according to the hospital type and medical professions.

\textbf{Results:} Our results showed that although the national case mix (i.e., the sum of all of the DRG cost-weights produced in one year) did not change between 2003–2006, the trend of the annual number of cases increased, and the average length of stay decreased. During 2007–2008, a significant decline was found in each indicator. The introduction of the PVL resulted in a health insurance budget saving of 1.9\% in 2004, 2.6\% in 2005, 3.4\% in 2006, 5.6\% in 2007, and 3.2\% in 2008. We found the lowest reimbursement rate per DRG cost-weight at the university medical schools (HUF 138,200 or € 550) and children’s hospitals (HUF 132,547 or € 528), whereas the highest was at the county hospitals (HUF 143,451 or € 571) and city hospitals (HUF 142,082 or € 565).

\textbf{Conclusions:} The implementation of the PVL reduced the acute care hospital activity and reimbursement. The effect of the PVL was different on the different types of hospitals, and it had a serious disadvantageous effect on the university medical schools and children’s hospitals.

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1. Introduction

Hungary was among the first European countries to introduce DRG-based hospital financing. The preparation for the introduction began at the end of the 1980s, and in 1993, it was introduced as a financing method for acute hospital care in every hospital in the country. Whereas the German DRG system relies on the Australian Refined DRGs (AR-DRGs), the Hungarian DRG system is a result of an independent developmental process. It was initiated with the development of a minimal dataset on which the
data were collected from sample hospitals. Subsequently, from 1987 to 1991, more detailed data were gathered from approximately 10% of Hungarian hospitals. The cost assessments and analyses and the Hungarian grouping algorithm were completed. The International Code of Diseases (ICD) and the International Code of Procedures in Medicine (ICPM) coding systems issued by the WHO for the classification of diseases and medical interventions were implemented directly into the Hungarian DRG system.

In many countries, in addition to the typical hospital financing techniques (including DRG, fees for service, and daily fees), a financial ceiling or upper limit is applied to maintain the health care budget at the national or regional level [1–5].

During the application of the DRG system in Hungary, to moderate the prompting effect of the activity based financing of the DRG, in 2004 an upper financial ceiling was introduced, namely the performance volume limit (PVL). The essence of the PVL was to implement an upper limit or ceiling on the annual activity of the hospitals, defined in the DRG cost-weight. The National Health Insurance Fund Administration (NHIFA) will not reimburse at all or will reimburse only partially the patient care costs exceeding this limit.

Quentin et al. defined the DRG cost-weight as the average costs of the DRGs divided by a reference value that is conceptually related to the average cost of treating all of the cases in Germany [6]. According to the Hungarian definition of the DRG cost-weight, it is “usually calculated from information about average treatment costs of patients falling within a specific DRG in at least a sample of other hospitals in the past” [7]. The Hungarian National Health Insurance Fund Administration establishes the DRG cost-weights. The reimbursement of the DRG cost-weight is calculated by the following method: the cost-weight of the individual DRG group is multiplied by the DRG base reimbursement rate. For example, the cost-weight of the DRG “344D Cholecystectomy” is 1.62885, the DRG base rate is 150,000 Hungarian Forints (HUF), and the reimbursement is 244,327 HUFs. The Hungarian PVL regulation did not change the cost-weight of the individual DRG groups; however, an upper ceiling was established at the hospital level as the total number of annual DRG cost-weights.

From 2004 to 2006, the patient turnover above the limit was financed in a so-called degressive way in the Hungarian PVL system. In this period, the base for the PVL was 98% of the activity of the previous year, which indicates a 2% decrease in the total hospital budget. The performance above the PVL ceiling was partially financed as follows: by 60% in cases of a 0–5% increase over the PVL, by 30% in cases of a 5–10% increase over the PVL and by 10% in cases of a higher than 10% increase over the PVL. Between 2006 and 2008, the base for the PVL was further reduced to 95% of the activity of the previous year. The patient turnover above the limit was not reimbursed. A more detailed description of the Hungarian health care system can be found elsewhere [8–15]. Information in the international scientific literature on the effect of cost-containment tools on hospital financing does not exist or is limited.

The objective of our paper is to analyse the effect on the DRG-based reimbursement of acute inpatient care in Hungary by the PVL as a cost-containment tool.

2. Material and methods

The data in this analysis are derived from the reports submitted by institutions to the National Health Insurance Fund Administration and refers to acute inpatient care.

We explored the data on the acute inpatient care cost-weights and the number of cases for reimbursement between 2003 and 2008. The DRG cost-weights and the number of cases are nationwide figures, including all of the data from the entire country (Figs. 1 and 2). For assessing the changes in hospital days, we calculated the average length of stay, whereas for the estimation of changes in the case-mix of patients, we calculated the case-mix of acute inpatient care (Fig. 3). In Hungary, the case-mix index is the mathematical average of the DRG cost-weight, and it is calculated by dividing the total number of the DRG cost-weights by the total number of cases.

To present patient turnover in detail, we analysed the annual number of cases to be reimbursed defined by progressivity levels between 2003 and 2008 (Fig. 4). Progressivity levels refer to the different types of hospitals (national medical institutes, university clinics, county hospitals, city hospitals, Budapest hospitals, and children’s hospitals). We compared the values of the years 2004–2008 with the value in 2003 on a 100% basis.
We explored the change in the annual average cost-weights HUF value between 2003 and 2008 (Fig. 5). The annual average HUF/cost-weights values were calculated in two ways, with a weighted average of the monthly cost-weights. The first is based on the published country-wide unified base fee (the pre-announced or theoretical HUF/cost-weights or the HUF/cost-weights value without degression), where we specified, in the segments (the national total, defined by progressivity levels) surveyed, which amount should have been reimbursed for a cost-weight without degression. In the other calculation, we computed the exact amount of money that had been reimbursed per cost-weight (the actual or degressed HUF/cost-weights value) following the application of the specific rules for the PVL.

In Fig. 6, we calculated the reimbursement per DRG cost-weight defined by the progressivity levels (national institutions, universities, county hospitals, Budapest hospitals, city hospitals, and children’s hospitals).

The relationship between the reduced acute care hospital activity and the reimbursement is as follows: as a first step, the health care financing agency limited the budget for hospital financing through the implementation of the PVL for each hospital. The reduced acute care hospital activity was a response by the hospitals to the PVL regulation.

During the study period, the value of one US dollar (USD) was 202.60 HUF in 2004 and 171.80 HUF in 2008, whereas the value of one euro (EUR) was 251.70 HUF in 2004 and 251.30 HUF in 2008.

### Results

Fig. 1 shows the annual total acute inpatient care cost-weights between 2003 and 2008. The annual total cost-weights in the first three years of the survey period (2004–2006) did not increase, which indicates that the PVL limited the increase of the homogenous disease group cost-weights. During 2007 and 2008, we observed that all of the cost-weight values significantly decreased.

Fig. 2 shows the annual number of cases to be reimbursed for acute inpatient care between 2003 and 2008. The trend of the annual number of cases to be reimbursed increased between 2003 and 2006; however, in 2007 and 2008, this index decreased remarkably.

Fig. 3 shows that the average length of stay significantly decreased from 7.2 days in 2003 to 5.8 days in 2008. The case-mix index showed a decreasing tendency from 1.13 in 2003 to 1.08 in 2008.

Fig. 4 illustrates the change in the annual number of cases for reimbursement for acute inpatient care defined by the progressivity levels between 2003 and 2008. Whereas between 2003 and 2006 the number of cases in the city hospitals (99.6%), city hospitals of Budapest (98.2%), and
county hospitals (102.7%) did not increase or increased at a minimum compared to 2003, the university medical schools (113.3%) and national institutions (114.3%) saw a considerable increase in the number of cases. The study indicates patient turnover shifts from the institutes at a lower level of progressivity to the university medical schools and national institutes. The national institutions experienced a dramatic decrease in the number of cases between 2006 and 2008 resulting from the closing of the National Institute of Psychiatry and Neurology.

Fig. 5 illustrates the annual theoretical (without regression) and the actual HUF/cost-weight reimbursement (minus regression) between 2003 and 2008. According to the published countrywide unified base fee for the DRG HUF/cost-weights, the theoretical HUF/cost-weights (or without regression or PVL) would have been an average of HUF 117,547 (€467) in 2004, HUF 132,064 (€532) in 2005, HUF 135,333 (€512) in 2006, HUF 143,359 (€570) in 2007, and HUF 146,000 (€581) in 2008. The actual HUF/cost-weights (minus regression) were HUF 115,352 (€458) in 2004, HUF 128,638 (€519) in 2005, HUF 130,791 (€495) in 2006, HUF 135,270 (€538) in 2007, and HUF 141,293 (€562) in 2008. Compared to the published countrywide unified base fee for the HUF/cost-weights, the following amounts were deducted per HUF/cost-weight: HUF 2195 (1.9%) in 2004, HUF 3426 (2.6%) in 2005, HUF 4542 (3.4%) in 2006, HUF 8086 (5.6%) in 2007, and HUF 4707 (3.2%) in 2008. Because of the effect of the PVL on the 2004 HUF, 5.8 billion (€22.8 million), the 2005 HUF, 9.1 billion (€36.9 million), the 2006 HUF, 12.1 billion (€45.6 million), the 2007 HUF, 18.8 billion (€74.9 million), and the 2008 HUF, 11.2 billion (€44.4 million), HUF has not been reimbursed to the hospitals.

Fig. 6 shows the annual average reimbursement rate for an acute cost-weight defined by the progressivity levels. The lowest amount was reimbursed (well below the approximately HUF 141,293 or €562 country average) to the university medical schools (HUF 138,200 or €550) and children’s hospitals (HUF 132,547 or €528), whereas the highest amount was reimbursed to the county hospitals (HUF 143,451 or €571) and the city hospitals (HUF 142,082 or €565) for their activity. Due to the special nature of children’s hospital, they had lower HUF/DRG cost-weight in previous years as well.

4. Discussion

The objective of our analysis was to demonstrate the numerical effects of the PVL on acute inpatient care. The annual total cost-weight values did not change between 2003 and 2006; however, in 2007 and 2008, they appreciably decreased. The introduction of the PVL resulted in a health insurance budget saving of 1.9% in 2004, 2.6% in 2005, 3.4% in 2006, 5.6% in 2007, and 3.2% in 2008. This finding indicates that the PVL method has achieved its aim, i.e., the performance index (cost-weights) that serves as a basis for reimbursement did not increase further and decreased after 2006. The saving indicates that after the introduction of the PVL system, the activity of the hospitals over their own limits has not been reimbursed. Despite the application of the PVL, the hospitals admitted and treated patients over their individual limits, which could be considered a cost saving measure for the health insurance budget. Without the PVL, we might assume that hospitals would produce even higher activity. Regarding the cost containment, the introduction of the PVL proved to be the right decision. The PVL system has rearranged the circulation or referral of patients between hospitals, without any changes in the reimbursement.

The number of cases for reimbursement decreased in 2007 and 2008, which shows that the hospitals have responded to financial restrictions; however, the number of cases increased in university clinics, which indicates that the restrictive effect of the PVL has ceased at the higher levels of progressivity, and that the system is “leaking” at this point. Because of the effect of the decreasing number of patient admissions between 2006 and 2008, long waiting lists developed in Hungary. The introduction of the PVL regulation might influence the quality of care. Although we do not have scientific analysis of the effect of the PVL on the quality of care, we assume the risk of declining quality. Some Hungarian newspapers have reported specific problems related to the introduction and continuation of the PVL system.

The degressive system appeared to stop the growth in hospital activity; however, it did not lead to a decrease. The decrease in output only became apparent from the time (June 2006) that overproduction was no longer reimbursed, indicating that a partial (degressive) reimbursement was not sufficient to decrease the activity of the hospitals. We assume that in the degressive zone, hospitals preferred to admit and treat patients for whom the hospitals’ variable costs were very low and for whom most of the costs of patient care were covered by the fixed hospital costs.

The significant result of our analysis is the numerical verification and confirmation that the circulation or referral of patients shifted from the institutes at a lower level of progressivity to the university medical schools and national institutes. Although the patients’ preferences changed and they selected other hospitals, the reimbursement over the PVL did not follow the patients. The providers most detrimentally affected by the introduction of the PVL system are the national institutes, the university medical schools, and the children’s hospitals because they experienced the greatest income decrease compared to the potential income during the whole study period. The closure of the National Institute of Psychiatry and Neurology in Budapest contributed to the increased number of patients in the city hospitals and the medical university in Budapest.

The case-mix of the patients changed after the introduction of the PLD system, which shows a decrease in complex cases. Informal reports from Hungarian newspapers confirm the decline in the number of unique and complex cases.

The average length of stay continuously declined between 2003 and 2008, which indicates that hospitals attempted to increase effectiveness by mobilising their internal reserves, i.e., by shortening the length of hospital stays. The reason for the decline is that the basis of the PVL was changed in 2006 (to 95% of the activity of the previous year), which resulted in the decrease of hospital
days. Although the DRG has a significant effect in reducing the hospital days [16], the introduction of the PVL system further reduced the number of hospital days.

The application of the DRG-based financing method has been widely used in many countries [17,18]. Although the basic DRG approach of grouping similar patients remains identical across countries, the basic design of the system differs to a great extent [19,7]. Adjusting the actual hospital costs to the average DRG reimbursement is a key element of the refinement process [20]. In many countries, the introduction of the DRG-based payment resulted in reduced intensity of care and shortened lengths of hospital stays [21]. There are policy recommendations for the establishment of a true ‘Euro-DRG’ system instead of the investment of possibly wasted resources to develop country-specific patient classification systems as the basis for the DRG systems [22]. In addition to the Euro-DRG approach, we would suggest a stable and calculable regulatory framework based on the DRG reimbursement.

A limitation of our study is that we focused only on a quantitative analysis of the PVL. Other factors might affect hospital care. The changes in the number of hospital beds, patient financial incentives, an economic crisis, emerging new medical technologies, and other factors could contribute to the performance of the hospital system.

5. Conclusion

The implementation of the PVL as a mechanical and solely fiscal tool reduced the acute care hospital activity and the reimbursement for acute care hospital activity by 1.9–5.6% between 2004 and 2008. The effect of the PVL was not identical on the different types of hospitals and had a serious disadvantageous effect on the university medical schools because of the increased number of patients they treated (Fig. 4). The university clinics were not able to refer patients to other hospitals; therefore, their activity exceeded the PVL, without reimbursement. Further application of the PVL requires refinement and correction based on the actual patient turnover because the limit is unable, as an upper ceiling for hospital reimbursement, to manage the reimbursement of hospital activity over that ceiling.

References