

## LABOR PRODUCTIVITY WITHIN THE EMERGENCY MEDICAL SERVICE IN THE CZECH REPUBLIC

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### Abstract

*In the frame of health care facilities effectiveness is very important to observe and regularly evaluate not only medical, but also economic indicators for assuming the highest possible accessibility of the healthcare for most of population. The aim of this paper is to describe and evaluate the Emergency Medical Service labor productivity as the important indicator of the economic effectiveness. For objective measurement were chosen significant economic and performance indicators. For the purpose of the presumptive measurement of the pre hospital emergency care effectiveness was propose the structure of applicable indicators.*

**Key words:** emergency medical service, healthcare system economy, labor productivity

### INTRODUCTION

The measurement of the aggregate effectiveness within health care providers is very wide area, from which the most sensitive part is the evaluation of medical treatment effectiveness. The main tool for this evaluation is the analysis of added value described by the life rescue or alleviation of suffering and the patient recovery to normal life. This is one of reasons why every medical treatment is provided according to current scientific findings which are taking the exact frame to the care. The next area with the crucial importance for each organization or company is the managerial and economic activity which has the role to assure maximum of sources and their effective allocation for the health care provision, so that every specialization is supported by the best possible conditions for professional activity. The exact frame of managerial and economic area is also build on current scientific findings and best practice as well as the medical part. The same principles are possible to find also in the healthcare service and also within the Emergency Medical Service (EMS). Effectiveness measurement of the real life activity assumes the input of basic data and creates the information base of the management for supporting the unbiased decision making process instead of the subjective and unqualified decisions. As well as the physician or other responsible medical professional decides about the treatment according to clinical status of the patient, also the responsible and qualified manger must made his professional decisions on the basis of correct information.

### Labor productivity

The term of Labor productivity is been perceived especially in industry as the key aspect of success. It represents basic aspect of effective usage of disposable sources in manufacturing process from the point of view of real utilization of workforce and technical assets potential. This approach is considering with given specifics possible to implement on non industry area, provision of commercial, noncommercial and public services. From the theoretical point of view is possible to see the labor productivity as the key success factor of commercial services, because especially by this type of business activity is the main part of added value determined by the performance of each individual or team cooperating on the same project. Detailed analysis afterward shows the real economic profitability. For the labor productivity analysis is not necessary to use very difficult and sophisticated tools of economic analysis. Essentially it is about the ratio indicator of the labor costs and chosen indicator of production, for instance number of finished goods, serving customers or total value of provided services. The nonproduction sphere is disadvantaged because of the fact that it is impossible

to produce to produce supplies, which is the common tool for the management of industry sphere. Provision of the health care as the service is primarily demanded and consumed according to actual health needs of the patient, however in the case of non acute cases it is possible to postpone it by using waiting lists and systematic appointment policy. Calculation with personal costs is here more than necessary because they are the dominant part of total costs (Tomáš Halajčuk, 2013). This rule is fully applicable by the EMS providers.

The work productivity analysis is applicable not only on the enterprise level, but also on the sector or national level. In this case, the real labor productivity is possible to count as the ratio between Gross Domestic Product (GDP) and the total amount of working hours. According to the data provided by the Czech Statistical Office, was the average product of single working hour in the Czech Republic in 2013 428 CZK (approx. 16 EUR), which in comparison with 1995 represent the real increase (after conversion on current prices) of 59,7%. In the health sector within the Czech Republic is possible to count the labor productivity by the use of the Institute of Health Information and Statistics of the Czech Republic (IHIS CR) data as follows:

$$\frac{\text{number of employees} \times \text{weekly woking hours} \times (\text{weeks per year} - \text{holliday and days off})}{\text{total health expenditures}}$$

After fulfilling each columns based on the Annual report of IHIS CR (250233 employees\*42.5 hours weekly\*52 weeks total – 5 weeks off)/ total health expenditures is possible to reach the number 595 CZK (approx. 22 Euro), which represents average product of one working hour in health sector in the Czech Republic.

### **Labor productivity in health sector**

Although the health care is possible to perceive as the very specific service, which production is not possible to fully cover by economic means, for the effective management of health institutions it is crucial to use all modern methods for assuring the long term and stable functioning. Resources given on every health service will be always limited without the level of GDP. The nature of health services for more causes, that the added value is created mostly by the human work factor, nevertheless the fact of increasing importance of using modern scientific methods based on the use of very sophisticated and also expensive appliances and equipment. But the last decision of further care continue is even based on the human factor represent by the competent health professional. Health professionals as the labor group are characteristic by its high education level and after that the whole life continuing educational process with the high level of responsibility for their work outputs and common pursuit of the profession in shift work. This is the reason, why the educational phase and also the practice very demanding and the value of skilled medical professionals and also their labor relatively high. From the economy theory point of view it is dealing with rare sources which is necessary to allocate effectively for the best utilization of labor potential.

### **Emergency Medical Service Labor productivity**

The EMS as pre hospital emergency medical care provider is based on two main professional groups which are divided to other subgroups:

1. The executive branch
2. CSU
3. Operational center
4. The supporting branch
5. Logistics
6. Administration and economics
7. Technical support

Composition of CSU differs in the Czech Republic according to the composition and also purpose of assets. The types are as follows:

1. Rapid Medical Rescue Unit

Ambulance crew included physician

2. Rapid Paramedical Rescue Unit

Ambulance crew based on Paramedics

3. Rendezvous Rescue Unit

Small car with physician on board determined to meet the Rapid Paramedical Rescue Unit in case of necessity

4. Helicopter Emergency Medical Unit

Crew of the HEMS including physician

According to accessible data of individual EMS it is not possible to calculate the real labor productivity on the level of each CSU or individual employer, but this issue is not the aim of this paper aimed on the macroeconomic point of view on the EMS labor productivity. For this purpose were chosen indicators:

1. Number of treated patients/CSU
2. Number of treated patients/number of employees
3. Total payroll costs/number of interventions
4. Income from Health insurance companies/number of employees

**Number of treated patients/CSU**

This indicator allows describing the average number of treated patients by one CSU during one year period. This parameter measures the intensity of CSU crews as main EMS productive units. From Tab. 1 is possible to explain, that the highest utilization is reported by the Prague Capital EMS, where excluded 2011 (doubled number of CSU crews reported) the intensity of labor units production reaches more than 3000 treated patients per year. For instance in 2013, when the number of treated patients by one CSU was 3480, the deeper analysis shows that during 24 hours treated the Prague Capital EMS 9.53 patient, which means one patient each 2.5 hours. On the other end of the schedule is the Pilsen Region EMS, which in 2010 reported 954 patients on one CSU, which introduce 2.6 treated patients during 24 hours, respectively one intervention each 9.2 hours. Average numbers for the whole EMS in the Czech Republic in 2009 – 2013 was 1663 treated patients on one CSU, which means 4.6 treated patients each 24 hours and one intervention each 5.3 hours. Mentioned outputs is necessary to count together with the real set of circumstances and conditions of each region, such as the demography, population density and others, when it is necessary for EMS to follow the rules of law, for instance the maximal arrival time 20 minutes, etc.

|                   | 2009  | 2010  | 2011  | 2012  | 2013  |
|-------------------|-------|-------|-------|-------|-------|
| Prague            | 3,493 | 3,027 | 1,533 | 3,315 | 3,48  |
| Central Bohemian  | 1,277 | 1,411 | 1,208 | 1,33  | 1,713 |
| Moravian-Silesian | 1,649 | 1,621 | 1,629 | 1,595 | 1,584 |
| Usti              | 1,773 | 1,824 | 1,918 | 2,015 | 2,091 |
| Olomouc           | 1,73  | 1,741 | 1,721 | 1,76  | 1,693 |
| South Moravian    | 2,32  | 1,601 | 2,088 | 1,78  | 1,677 |
| Liberec           | 1,785 | 1,965 | 2,073 | 2,025 | 2,112 |
| Zlin              | 1,498 | 1,237 | 1,587 | 1,709 | 1,787 |
| Southern Bohemian | 1,435 | 1,417 | 1,446 | 1,451 | 1,42  |
| Vysocina          | 1,43  | 1,275 | 1,256 | 1,32  | 1,363 |
| Hradec Kralove    | 1,473 | 1,456 | 1,305 | 1,368 | 1,376 |
| Pardubice         | 1,512 | 1,662 | 1,448 | 1,597 | 1,721 |
| Pilsen            | 1,491 | 0,954 | 1,242 | 1,12  | 1,157 |
| Karlovy Vary      | 1,082 | 1,043 | 1,079 | 1,704 | 1,44  |
| Average           | 1,71  | 1,588 | 1,538 | 1,721 | 1,758 |

**Figure 1.** Numbers of treated patients on one CSU per year (2009-2013)

The aim of this paper is not to evaluate the EMS as the manufacturing company, but to measure the economic performance of chosen part of productive capital. On the base of calculated indicators is possible to lead a discussion, if it is better for the society, government, service provider or citizens the maximal utilization which can lead to over usage or the maximal savings of EMS providers by the intervention reductions.

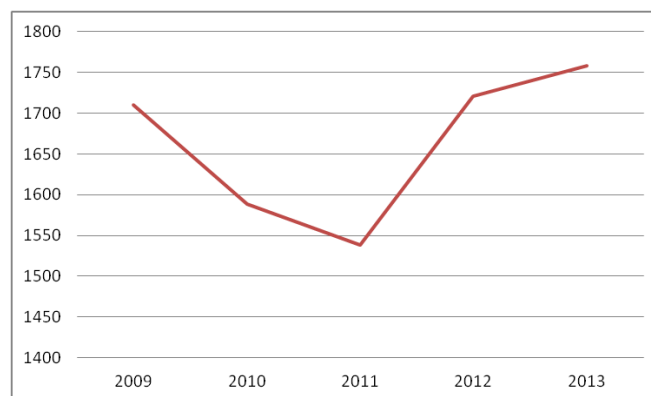


**Figure 2.** Middle term development of average numbers of treated patients by one CSU per year

According to Figure 2 is possible to describe the significant increase of average number of treated patients by one CSU between 2011 and 2012, what is most probably caused by the stabilization of the CSU number together with the amplitude of intervention.

### Number of treated patients/number of employees

For describing the real performance of regional EMS is suitable to use the ratio of treated patients number and total number of employees. This indicator introduces the total performance of whole EMS

each. It really is the basic indicator of medical care productivity. Moreover it helps to show the ratio between productive and non productive part of EMS. Figure 3 indicates the increase of average number of treated patients which fully corresponds with the increase of total numbers. Highest ratio between number of EMS employees and treated patients is possible to find by Prague Capital EMS with 253 (patients/one EMS employee). The opposite is made by the Karlovy Vary Region EMS with 78.5 (patients/one EMS employee). Main reason of this difference is most probably made by the fact, that Karlovy Vary Region is the smallest Czech region and also the EMS is following this fact, which means less CSU, but the supporting part must have the same functionality like by much bigger EMS.

|                   | 2009 | 2010 | 2011 | 2012 | 2013 |
|-------------------|------|------|------|------|------|
| Prague            | 222  | 228  | 225  | 240  | 253  |
| Central Bohemian  | 109  | 137  | 129  | 143  | 171  |
| Moravian-Silesian | 124  | 132  | 134  | 134  | 135  |
| Usti              | 120  | 120  | 127  | 131  | 155  |
| Olomouc           | 142  | 143  | 142  | 146  | 151  |
| South Moravian    | 150  | 136  | 137  | 139  | 143  |
| Liberec           | 137  | 174  | 214  | 202  | 202  |
| Zlin              | 121  | 121  | 123  | 133  | 137  |
| Southern Bohemian | 121  | 129  | 127  | 137  | 144  |
| Vysocina          | 106  | 101  | 100  | 102  | 104  |
| Hradec Kralove    | 115  | 121  | 115  | 120  | 122  |
| Pardubice         | 109  | 126  | 124  | 135  | 152  |
| Pilsen            | 120  | 86   | 98   | 99   | 99   |
| Karlovy Vary      | 81   | 79   | 82   | 130  | 122  |
| Average           | 127  | 131  | 134  | 142  | 149  |

**Figure 3.** Number of treated patients/number of employees (2009 and 2013) by regions

The trend of the number of treated patients to number of EMS employees' rate is almost linear which means that the ratio between executive and supporting branches became stable. If using economic terms, the production of EMS grew of average 4.1% each year what made the 2009-2013 17% increase. Similar stability in growth is possible to assume in next year's, because total numbers of EMS labor is stable, but it is predicted the slow increase in the number of patients.

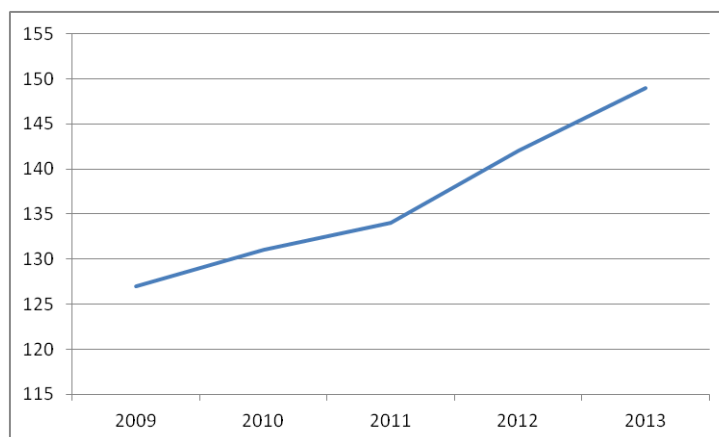


**Figure 4.** Trend of average number of treated patients per year and employee

### Total payroll costs/number of interventions

In this part of the analysis is described the indicator of total payroll costs against total EMS production based on number of interventions. Like it was described earlier, the EMS consist from executive and support branch, which needs deeper analysis to calculate average payroll costs for each CSU or employee, from this reason it is much common to use the ratio against the production unit represented by individual patient. This indicator of labor productivity is very similar to those used in commercial services or industry, where the main attention is taken to the whole company and not only single unit effectiveness. From Figure 5 is possible to see, that the lowest payroll costs calculated to one patient is possible to find in Prague Capital EMS with 1.899 CZK in 2013, whereas the highest number is 5.133 CZK in 2014 Pilsen Region EMS. Figures are strongly determined by the frequency of interventions.

|                   | 2009 | 2010 | 2011 | 2012 | 2013 |
|-------------------|------|------|------|------|------|
| Prague            | 1953 | 1998 | 2015 | 1953 | 1899 |
| Central Bohemian  | 4038 | 3445 | 3728 | 3528 | 2926 |
| Moravian-Silesian | 3185 | 3276 | 3472 | 3634 | 3561 |
| Usti              | 3077 | 3221 | 3248 | 3232 | 2982 |
| Olomouc           | 2854 | 2955 | 3108 | 3184 | 3108 |
| South Moravian    | 2798 | 3217 | 3506 | 3551 | 3470 |
| Liberec           | 2206 | 2194 | 2567 | 2770 | 2566 |
| Zlin              | 3389 | 3401 | 3476 | 3269 | 3243 |
| Southern Bohemian | 3359 | 3360 | 3664 | 3561 | 3510 |
| Vysocina          | 5272 | 4104 | 4436 | 4561 | 4524 |
| Hradec Kralove    | 3626 | 3561 | 3851 | 3933 | 4045 |
| Pardubice         | 3982 | 3523 | 3807 | 3576 | 3255 |
| Pilsen            | 3394 | 5315 | 4820 | 5249 | 5133 |
| Karlovy Vary      | 4935 | 5179 | 4765 | 3543 | 3804 |
| Average           | 3434 | 3482 | 3605 | 3539 | 3430 |

**Figure 5.** Total payroll costs/number of interventions (2009-2013)

From the middle term point of view is the development possible to evaluate as unstable, but during last three years with the constant linear decreasing trend. Because wages are the biggest part of EMS costs,

this trend is very positive and important for possible investment and stability. The shape of this trend is a mirror picture of the indicator Average numbers of treated patients by one CSU (Figure 6). This fact causes the rule, that with the increase of patients the salaries are the same.

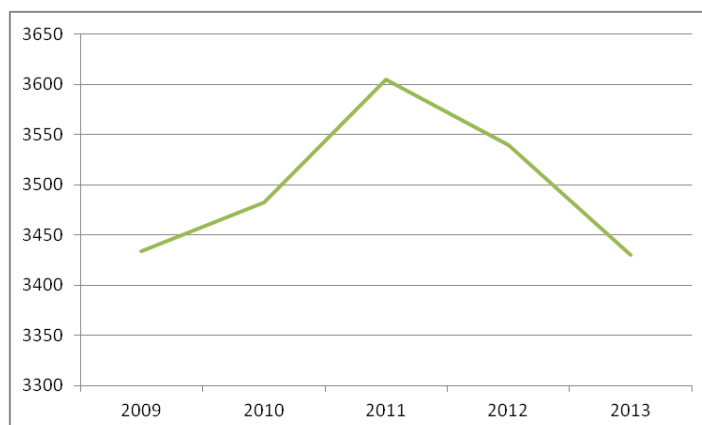


**Figure 6.** Payroll costs per patient (2009-2013)

#### **Income from Health insurance companies/number of employees**

The main indicator of proceeds effectiveness is the ratio of health insurance companies and number of EMS employees. For the calculation it represents only a part of the EMS income, because only the insurance company returns are mirroring the real performance based income. The second most important part of EMS income, the contributions from the regional government assure the non performance part, e.g. preparedness for emergency. If all incomes will be calculated together, it would distort the predictive value and the final information would become non objective. Highest proceeds from health insurance receive the Prague Capital EMS by 388,467 CZK on each employee in 2013 and also Central Bohemian Region EMS with 361,352 CZK and Liberec Region EMS 360,314 CZK. On the other side, the lowest proceeds from health insurance receives the Moravian-Silesian Regional EMS with 273,633 CZK in 2013.

|                   | 2009    | 2010    | 2011    | 2012    | 2013    |
|-------------------|---------|---------|---------|---------|---------|
| Prague            | 298,382 | 322,866 | 317,693 | 361,917 | 388,467 |
| Central Bohemian  | 236,522 | 261,794 | 275,204 | 315,63  | 361,352 |
| Moravian-Silesian | 234,621 | 254,151 | 259,317 | 268,279 | 273,633 |
| Usti              | 269,465 | 286,938 | 316,127 | 335,303 | 333,493 |
| Olomouc           | 265,744 | 272,728 | 276,677 | 296,052 | 315,283 |
| South Moravian    | 266,086 | 283,484 | 282,097 | 320,164 | 343,4   |
| Liberec           | 202,624 | 223,225 | 330,27  | 367,208 | 360,314 |
| Zlin              | 263,418 | 279,675 | 283,271 | 313,61  | 334,929 |
| Southern Bohemian | 266,713 | 282,169 | 276,167 | 291,977 | 307,853 |
| Vysocina          | 278,421 | 281,457 | 275,04  | 295,705 | 298,316 |
| Hradec Kralove    | 235,337 | 251,923 | 265,703 | 293,948 | 320,191 |
| Pardubice         | 292,605 | 271,007 | 292,831 | 323,809 | 359,04  |
| Pilsen            | 802,753 | 257,128 | 239,835 | 296,498 | 318,068 |
| Karlovy Vary      | 262,91  | 267,373 | 292,423 | 356,919 | 374,213 |
| Average           | 298,257 | 271,137 | 284,475 | 316,93  | 334,897 |

**Figure 7.** Income from Health insurance companies/number of employees 2009-2013

Indicator of health insurance proceeds calculated on one employee describes total economic performance of the EMS system. The increasing trend is common in comparison to increasing of the payment for one patient and also the total number of treated patients. The curve shape also confirms the stabilization of EMS number of employees and indirectly the share of executive and support branch.

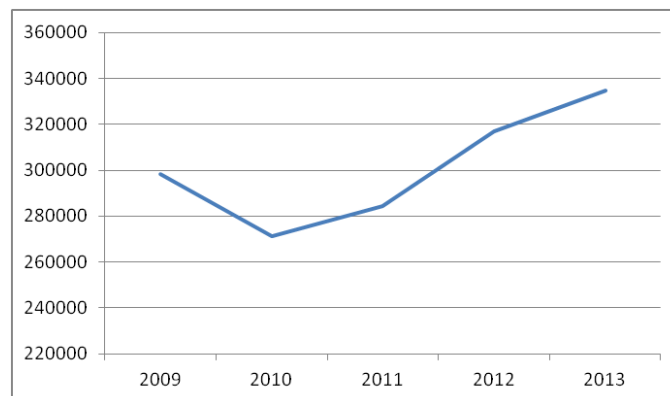


**Figure 8.** Income from health insurance per employee 2009-2013

## **CONCLUSION**

The observation of health care facilities effectiveness is doubtless very interesting and important aspect of long term sustainability. For objective and independent evaluation it is crucial to compare economic and medical indicators.

Based on mentioned information is possible to stated, that in observed term increased the EMS performance, because also total number of treated patients increased also in relationship with to single CSU and also to the number of employees. The results indicate the stable EMS structure without increasing numbers of support branch. Also the wage demands on single intervention, which caused the real and well measurable increase of EMS economic effectiveness.

## **ACKNOWLEDGEMENTS**

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