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Health Care Efficiency in the Czech Republic – Evidence for Inpatient Care

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1 Introduction

Czech inpatient care facilities absorb a considerably high share of healthcare resources. Compared to other EU countries, the number of per capita hospital admissions is very high too (WHO, 2003–2012). Also other health care indicators, such as the reported length of stay for inpatient interventions and the low share of day cases raise concerns about cost-effectiveness in the Czech healthcare sector.

This paper analyzes the Czech inpatient sector and identifies specific areas worth targeting in order to increase inpatient care efficiency. It starts with the description of stylized facts in Section 2 where the Czech healthcare indicators are put into an international/EU context. Cross–sections and time–series of data are presented for selected indicators of inpatient care efficiency.

After a review of relevant references to international and domestic studies, the paper deals with relative cost efficiency of Czech general hospitals using efficiency benchmarks. Efficiency benchmarks aim to determine the maximum feasible set of outputs which can be produced from a given set of inputs in a particular setting. Two sets of efficiency scores are presented. The two sets differ in the vector of variables used as outputs and determinants of inefficiency, and the models employed. The first model is a parametric stochastic frontier analysis accounting for inefficiency determinants, while the second one is a non–parametric free–disposable hull conditional order–m efficiency model. Results of the two models complement each other and jointly report about efficiency of Czech general hospitals.[1]

Effects of determinants of inefficiency of hospitals are thoroughly examined. A number of variables are considered, which either explain lower efficiency scores or point to specific policy areas that need to be targeted in order to increase efficiency of hospitals. In this context, the current setup of the DRG reimbursement system is discussed. It is still a relatively new phenomenon and much needs to be improved for the Czech Republic to be able to reap the full potential that the DRG system represents both for efficiency benchmarking of hospitals and increase in hospital efficiency per se. Drawbacks of the current setup of the DRG reimbursement system and potential for its improvement is discussed. Capital investment of hospitals and daycare interventions are discussed in relation to the case–mix reimbursement system.

Day care is not yet very well ingrained in the Czech healthcare system. The data on day care has officially been collected only since 2012. The number of day care interventions in 2012 is very low, however, it is expected to increase in the future. This will enable an efficiency analysis of day care interventions in the years to come.

Each section presents specific policy recommendations and outlines a possible design for an appropriate incentive structure. Policy recommendations from all sections are then summarized at the end.

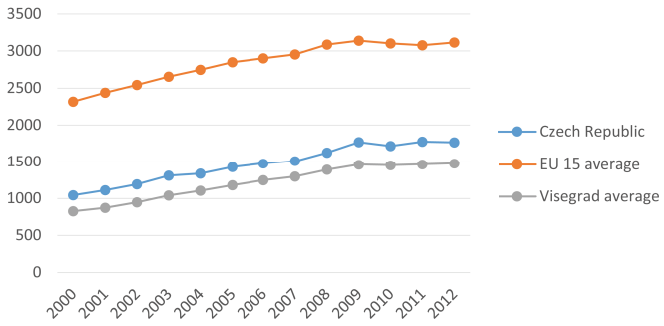
[1] The non–parametric conditional order–m approach is less sensitive to extreme observations than traditional non–parametric frontiers and thus is more comparable to stochastic frontiers. However, note that by definition, fully efficient observations may exceed the score of 1.

2 Facts

2.1 Healthcare expenditures

In 2012 as much as 11,346.31 mil EUR/ 16,720.57 EUR in PPS (EUROSTAT, 2003–2012) was spent on healthcare in the Czech Republic. It makes 1,591.61 EUR per capita in PPS (EUROSTAT, 2003–2012). In relative terms, per capita expenditures on healthcare in 2012 was 20 % above the average of the Visegrad countries (including Czech Republic, Poland, Hungary and Slovakia), however, 43 % below EU-15 average (OECD, 2000–2012)[2]. Over the last 13 years, the per capita expenditures on healthcare in the Czech Republic has followed an increasing trend of other EU countries (Figure 1).

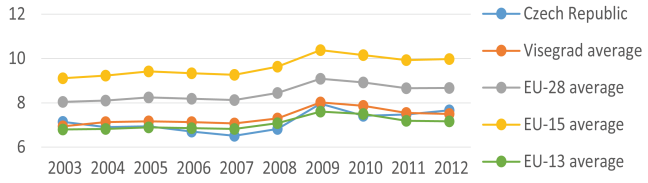
Figure 1. Total current expenditure on healthcare per capita, USD 2005 PPP rates, 2003–2012



Source: OECD (2000–2012)

When expressed as a percentage of GDP, the Czech Republic spent 7.41 % of GDP on healthcare in 2010 (OECD (2000–2012) last available data). WHO (2003–2012) then estimates healthcare expenditures to be 7.48 and 7.66 % of GDP in 2011 and 2012, respectively. This puts the Czech Republic below the average of EU-28 and EU-15 countries, however on the average of EU-13 and Visegrad countries (Figure 2).

Figure 2. Total health expenditure % of GDP, WHO estimates, 2003–2012

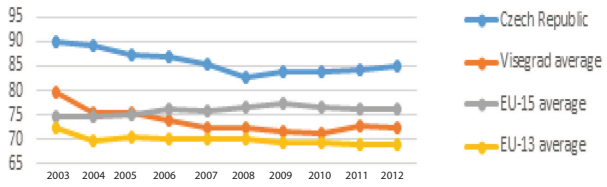


Source:WHO (2003–2012)

[2]EUROSTAT (2003–2012) does not provide data for all EU–15 countries.

Of all the EU countries, the Czech Republic finances most of its healthcare publicly - in 2012 nearly 85 % of total health expenditure was public compared to 76 % in EU-15 countries or 72 % in Visegrad countries (WHO, 2003–2012). As Figure 3 shows, the share of public spending decreased slightly in 2008 when user charges for an ambulatory doctor visits and an inpatient day were introduced, however, afterwards the share of public resources devoted to healthcare increased again.

Figure 3. Public-sector health expenditure % of total health expenditure, 2003–2012



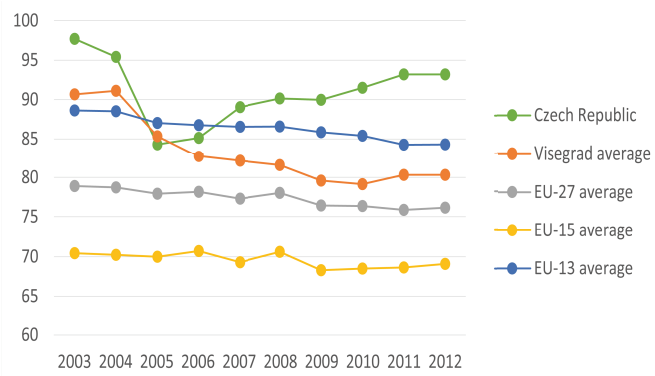
Source:WHO (2003–2012), estimates

Of all the private expenditure as much as 93 % was formed by household-out-of-pocket payments in 2012 which is the highest share compared to all EU-averages as obvious in Figure 4. The saddle in 2004 and 2005 may have partly been caused by changes in the methodology of data collection. Specifically, new private sources of financing were introduced when collecting the data (non-profit institutions serving households and corporations other than health insurance funds), thus by definition, out–of–pocket expenditures as a share of private sector expenditure suddenly decreased. Additionally, some of the drop could have happened as a result of the Czech Republic entering the EU in 2004, or due to the transfer of hospitals to newly established regions and subsequent corporatization in the period concerned. A marked increase which the Czech Republic experienced after 2008 was caused by the introduction of user charges and absence of any private insurance plan available to Czech citizens. If there was an increase in out–of–pocket payments as a percentage of private expenses in other EU countries at all, it was by no means as steep as in the Czech Republic.

Figure 5 provides a more detailed picture of the sources from which health expenditure was covered in 2003 and 2012 in the Czech Republic. Figure 5 again confirms a remarkable increase in private sector participation. On the other hand, public resources decreased and resources from the social security funds stayed at about the same level.

From all healthcare resources, as much as 32.6 % was directed to inpatient care in 2011. Inpatient care was then from 96.9 % financed publicly, which results in 31.59 % of all healthcare expenditures being public and directed to inpatient care (WHO, 2003–2012). The Czech Republic copies the general trend of the Visegrad average, however being significantly above it in all respects, i.e. larger share of resources is devoted to inpatient care and out of the amount devoted to inpatient care a larger share is financed publicly (Figure 6). Data for comparison across any group of other EU countries is missing.

Figure 4. Private household out-of-pocket expenditure % of private sector expenditure, 2003–2012



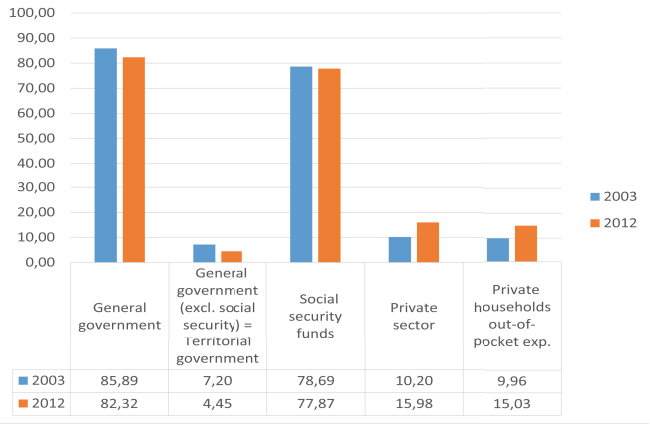
Source: WHO (2003–2012)

2.2 Inpatient care

Comparing inpatient expenditure in 2003 and 2011 in the Czech Republic, a decrease in all panels of Figure 6 is remarkable. It is connected with a goal to decrease the number of acute care hospital beds and increase the number of long–term beds. These attempts resulted in 12.6 % of 58,832 beds available in the Czech Republic in 2012 being dedicated specifically to long-term patients (UZIS, 2013).

International comparison of the number of hospital beds per 100 000 inhabitants in Figure 7 confirms the Czech trend to decrease the number of acute beds. Compared to EU–averages however, the Czech Republic still reports the highest numbers. The number of long–term care beds has been increasing since 2010 (in line with the policy target) after a drop in 2008–2009 (see also Table 1). **The number of Czech long–term care beds per 100 000 inhabitants**, is nevertheless still **significantly below EU–15** but above Visegrad and EU–13 averages (WHO, 2003–2012). Demand for long–term care stemming from aging population is expected to increase the number of long–term care beds in the future, were it not for an increase of other alternatives of care for the elderly (community–based services, home care, etc.).

Figure 5. % total expenditure on health, CZ, 2003 & 2012



Source: OECD (2000–2012)

Table 1. Bed availability in Czech hospitals, 2005–2012

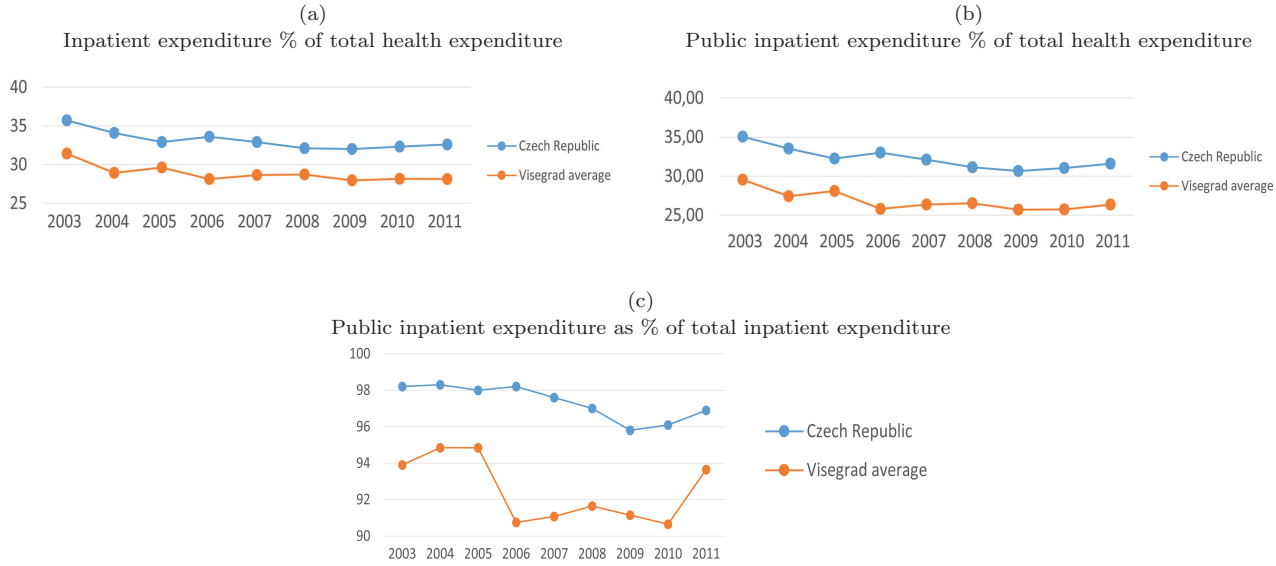
	Acute[a]			Chronic			Specialized Therapeutic Institutes		
	Hospitals	Beds	Beds\1000	Hospitals	Beds	Beds\1000	Hospitals	Beds	Beds\1000
2005	169	60,815	5.93	26	2,367	0.23	247	46,789	4.56
2006	164	60,313	5.86	27	2,408	0.23	162	22,521	2.19
2007	165	61,338	5.91	27	2,324	0.22	153	22,191	2.14
2008	164	60,915	5.82	28	2,348	0.22	154	22,005	2.10
2009	163	60,634	5.77	28	2,358	0.22	154	21,704	2.07
2010	159	59,702	5.67	30	2,517	0.24	157	21,764	2.07
2011	158	57,756	5.50	31	2,580	0.25	160	21,672	2.06
2012	156	56,262	5.35	32	2,570	0.24	158	21,470	2.04

	Psychiatric hospitals[b]		
	Hospitals	Beds	Beds\1000
	20	9,858	0.1
	20	9,762	0.09
	19	9,627	0.09
	19	9,540	0.09
	20	9,467	0.09
	20	9,318	0.09
	21	9,254	0.09
	21	9,097	0.09

Note: [a] Even though classified as acute hospitals, some also provide long–term care wards, thus the number of beds of acute hospitals comprise both acute and long–term beds.
[b] Separated from Specialized therapeutic institutes, sum of children and adults
Source: Institute of Health Information and Statistics of the Czech Republic (2006–2013)

In 2012, there were 188 hospitals in the Czech Republic with the total of 49,181 acute beds, 7,460 long–term beds and 2,191 new-born beds. As many as 156 hospitals provided either only acute care or a combination of acute and long-term care. In addition, 32 hospitals provided just long-term care. There were 11 hospitals with more than 1,000 beds and 44

Figure 6. Inpatient expenditure, 2003–2011



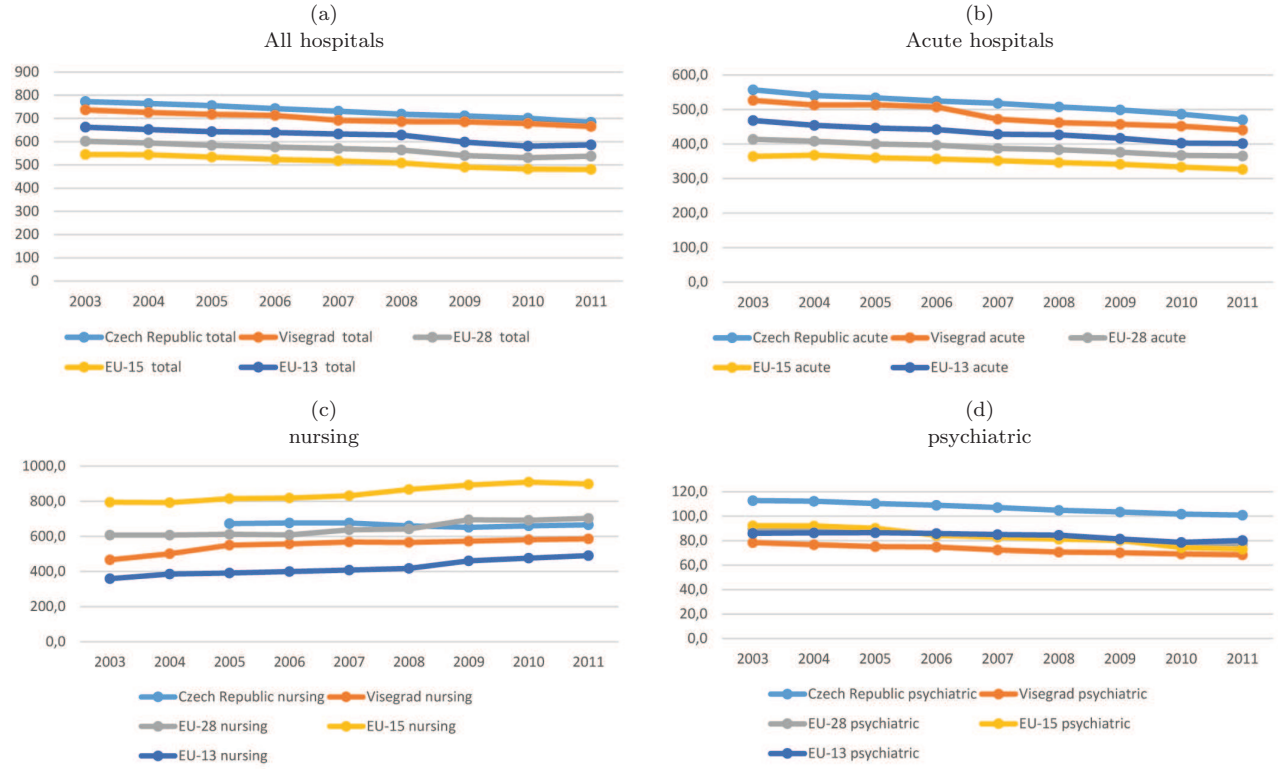
Source: WHO (2003–2012)

hospitals with less than 100 beds. Size of the hospital often correlates with the number of population of the place where it is situated. Large hospitals provide a wide portfolio of care, while smaller hospitals often treat only selected diagnoses. Lately some of these smaller hospitals directed their focus rather to provision of day-care and outpatient care. In addition, 160 specialized therapeutic institutes - which do not have a status of a hospital - provided specialized follow-up care particularly for long-term and chronically ill on 21,470 beds. After a remarkable decrease of the number of specialized therapeutic institutes between 2005 and 2006, the number of both hospitals and beds stabilized (Table 1).

Inpatient discharges per 100 inhabitants reached 20.5 in 2011 having experienced a steady decrease over 9 years (WHO, 2003–2012). However, it is **still the highest value compared to other EU countries** (Figure 8).

Keeping in mind the continuing policy target to increase efficiency of hospitals in the Czech Republic, **one would expect an increase and a sharper drop in occupancy rate and the acute length of stay, respectively**, than Figure 9 and Figure 10 reveal. For 2009–2011, Czech occupancy rate has decreased in absolute terms and roughly oscillated around the EU average in relative terms. The Czech average length of stay, has copied a decreasing trend of other EU countries over the whole period, however reporting significantly higher numbers.

Figure 7. Hospital beds per 100 000 inhabitants, 2003–2011



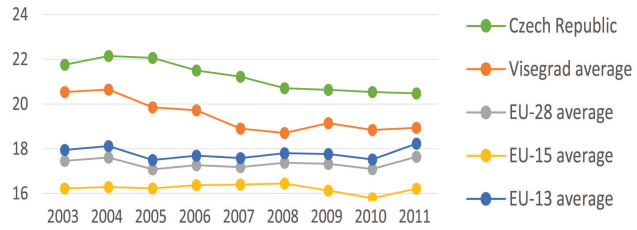
Source: WHO (2003–2012)

2.3 Capital in hospitals

In the period 2003–2012, capital formation expenditure of Czech hospitals was below the EU–old–member–state average but slightly above the EU–new–member state average (Figure 11). Czech general hospitals copy the trend for all Czech hospitals both in absolute values and as a percentage of GDP. Values and percentages of capital formation expenditures of all hospitals and general hospitals separately suggest that **general hospitals drive hospital capital investment** in the Czech Republic. Investment in hospitals of other types is only marginal. Expressed as percentage of GDP, capital investment has been significantly decreasing since 2009.

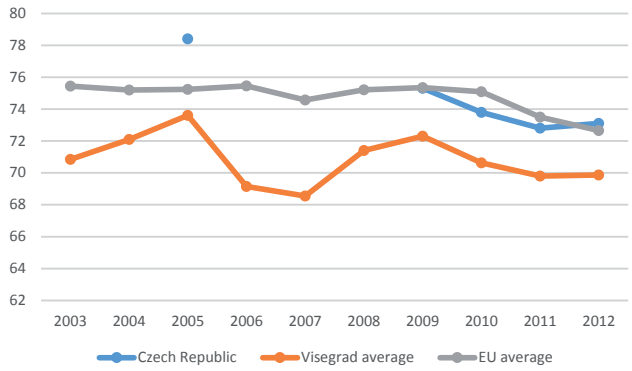
Hospitals owned by the Ministry of Health own most long–term assets expressed in monetary terms (Figure 12). However the rate of amortization of these assets reaches 47.2 %. Assets owned by budgetary regional; city and municipal hospitals are also quite old, with the amortization rate of 46 % and 48.9 %. Assets owned by hospitals managed by other legal entity have lost only 32.5 % of value so far (Institute of Health Information Institute of Health Information and Statistics of the Czech Republic, 2003-2013). Not surprisingly, most assets are owned by the largest hospitals.

Figure 8. Inpatient care discharges per 100 inhabitants, 2003–2011



Source: WHO (2003–2012)

Figure 9. Occupancy rate, %, 2003-2012



Source: OECD (2000–2012)

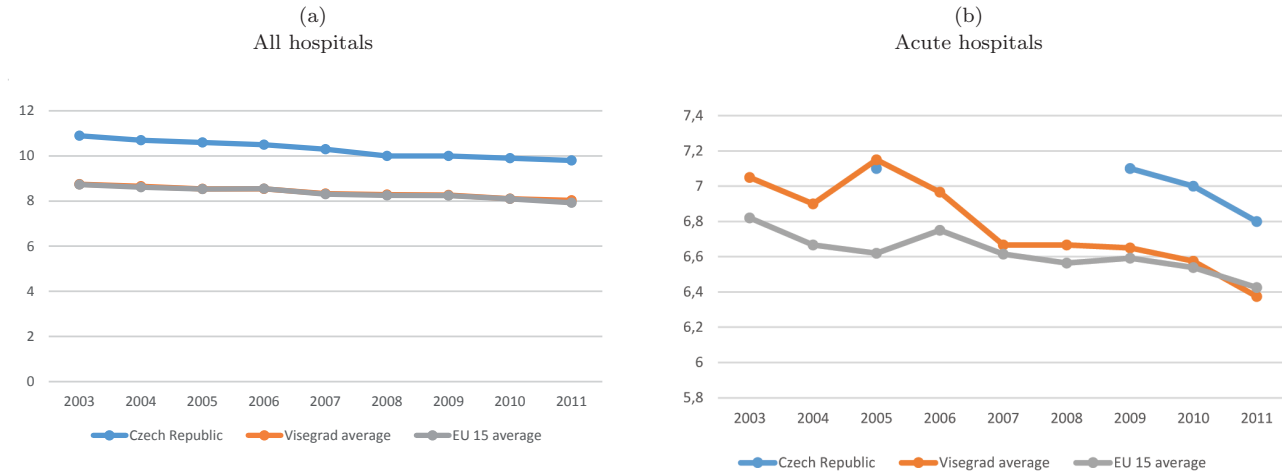
Note:17 EU countries available, including 12 old member states.

When equipment is bought, it is sometimes not put into operation immediately. It is either bought at the end of a year or it is put aside for another reason. Panels (c) and (d) of Figure 12 reveal that the former is the case of hospitals owned by the Ministry of Health and corporatized municipal and regional hospitals. Regional budgetary hospitals then report the largest share of capital which was invested in previous years and is still not in use (Table 2, column g).

Figure 13 shows that **the rate of amortization increases overtime and medical equipment of Czech hospitals ages**, keeping only 56 % of its original value in 2013. Value of of equipment not put into operation has been decreasing since 2009. Between 2010 and 2012 brand new investments lack behind the value of capital newly put into operation. In other words, during the crisis, hospitals were taking advantage of equipment previously set aside rather then undergoing brand new investments.

The Czech healthcare sector as a whole is better equipped with medical tech-

Figure 10. Average length of stay, 2003–2011, days



Source: OECD (2000–2012)

Table 2. Czech Hospital long–term tangible assets bought vs. put into operation, 2013

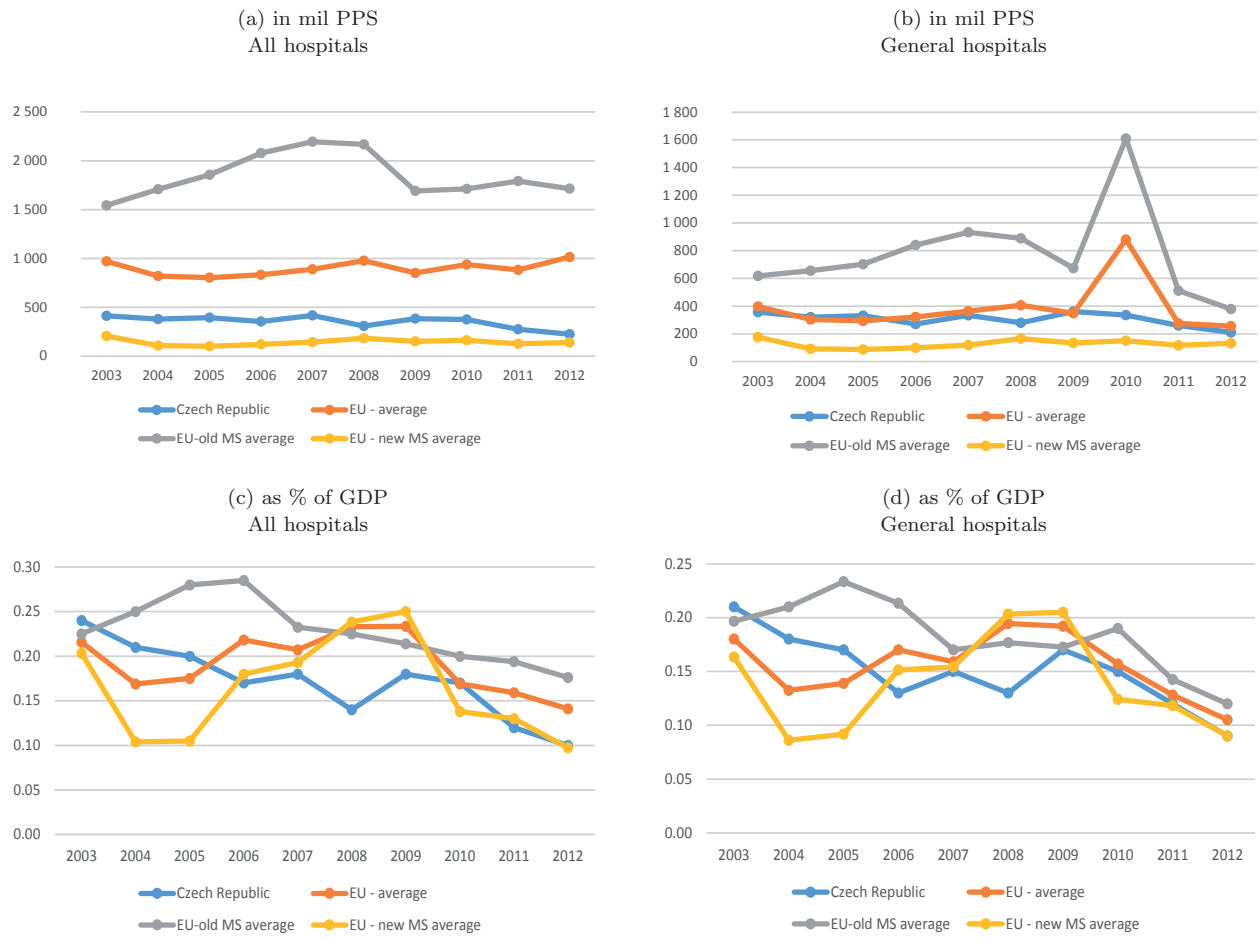
	long-term tangible assets					
	not put into operation	bought	newly put into operation	difference	not in use from previous year´s investments	long not in use %
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Ministry of health	1268	2 741	2 999	-258	1 010	80
Regional budgetary	325	631	595	36	289	89
Municipal and city budgetary	80	276	316	-40	40	50
Managed by other legal entity, ecclesiastical	1020	2748	1988	760	260	25
o.w. regional municipal joint-stock company	687	1826	1257	569	118	17
Managed by other central bodies	104	336	241	95	9	9
Total	2797	6732	6139	593	2 204	79

Source: Institute of Health Information Institute of Health Information and Statistics of the Czech Republic (2003-2013), own analysis

nology than the average of Visegrad countries, but fairly worse than OECD averages (OECD, 2013). In 2011, there were 6.9 Magnetic Resonance Imaging (MRI) units and 14.8 CT scanners per million inhabitants in the Czech healthcare sector, whereas OECD 28, respectively OECD 29 countries report 13.3 MRI units and 23.6 CT. An average Visegrad country reported only 5.4 MRI units and 12.7 CT scanner per million population.

Data on utilization of the MRI units and CT scanner show that the number of MRI exams per capita in the Czech Republic is lower (39.0 MRI exams and 89.5 CT exams per 1000 population) than average of the OECD 21, respectively 20 OECD countries (55.4 MRI exams and 131.0 CT exams per 1000 population) but by contrast higher than average of the Visegrad countries (31.0 MRI exams and 79.6 CT exams per 1000 population). Only Slovakia reports comparable data to the Czech Republic. Hungary and Poland indicate significantly

Figure 11. Capital formation expenditure of hospitals, 2003–2012



Source: EUROSTAT (2003–2012)

Note: EU average includes 7–10 countries

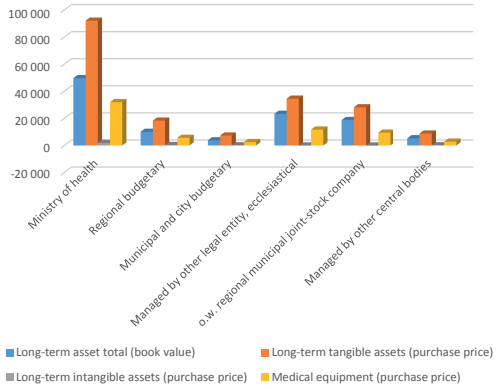
lower utilization of medical diagnostic devices. **Increasing utilization of the units both in the Czech Republic and other Visegrad countries will increase efficiency of the Czech healthcare system.**

2.4 What do we learn from this description?

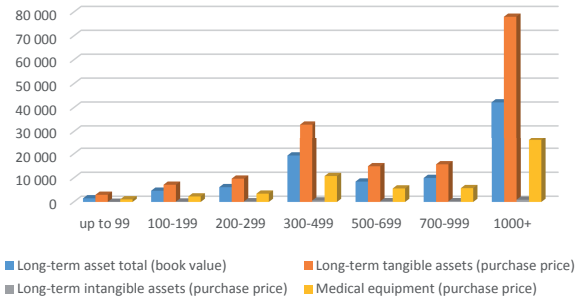
First hand observations in section 2 point to the potential for efficiency improvements of the Czech inpatient hospital sector. Specifically, overuse of hospital discharges and insufficient decrease in the length of stay over past years suggest the need for an increase of short–term and day care interventions. Capital equipment in hospitals, particularly acute hospitals, is aging and is underutilized which points to a scope for further efficiency improvements of the system.

Figure 12. Hospital long–term assets, CZ, 2013, mill. CZK

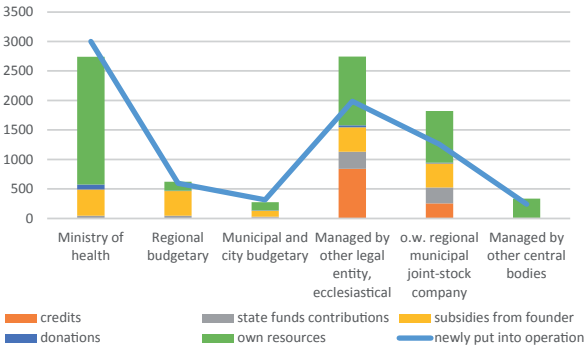
(a) by founder



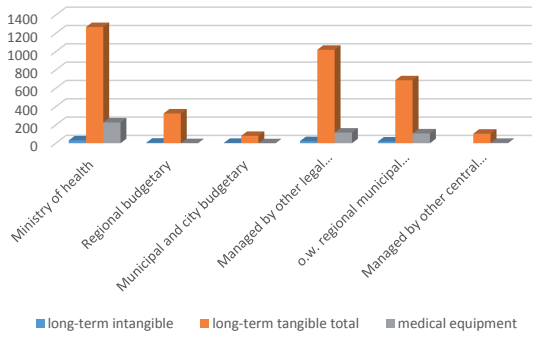
(b) by size



(c) purchase vs. put into operation



(d) not in use

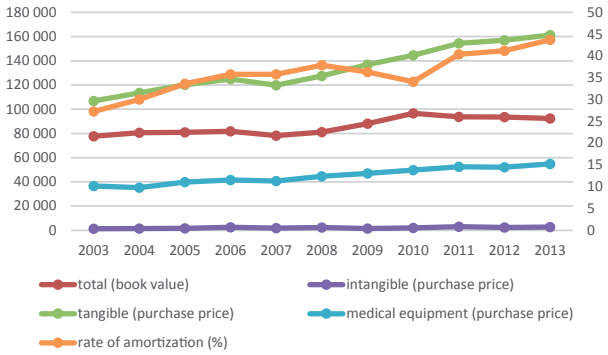


Source: Institute of Health Information Institute of Health Information and Statistics of the Czech Republic (2003-2013)

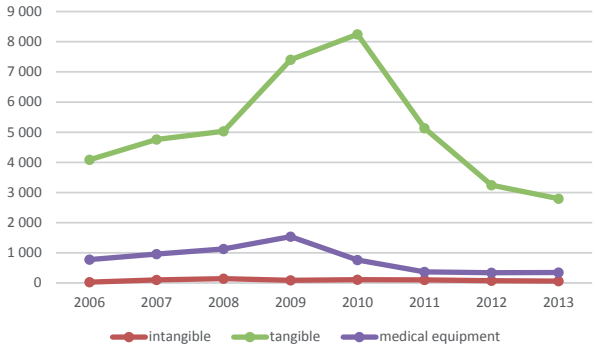
However, immediate conclusions from the first hand observation are often too hasty. Having introduced efficiency of the healthcare sector in the international context in section 3, this paper will review findings of two studies which deal with efficiency of Czech general hospitals. In section 4, it will shed light on inefficiency determinants and point to specific areas which need to be targeted to increase efficiency of Czech hospitals. Section 6 will link efficiency of Czech hospitals to their capital needs. Day care interventions will be discussed in section 7 and their potential for the future will be outlined.

Figure 13. Hospital long–term assets, CZ, 2003(2006)–2013, mill. CZK

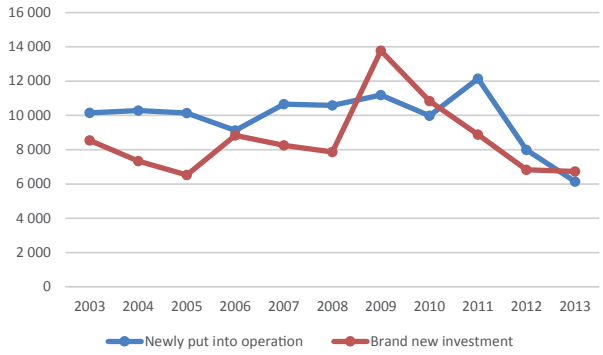
(a) owned



(b) not in operation



(c) purchase vs. put into operation



Source: Institute of Health Information Institute of Health Information and Statistics of the Czech Republic (2003-2013)

Stylized facts - Czech Republic:

- Financial expenditure per capita in PPS on healthcare comparable to Visegrad countries but below EU-average
- Highest public share of financing of all countries considered
- The absence of a private insurance plan results in out–of–pocket payments by the patients being the only source of financing
- A significantly larger share of resources devoted to inpatient care than in Visegrad countries
- Recent increase in the number of long–term care beds
- Ageing population is expected to exert further demand for long–term care (long–term care beds, hospice, home care, etc.) in the future
- Despite a steady decrease in the number of inpatient discharges per person still the highest values among all EU countries
- Acute care length of stay decreased, even though not sufficiently, and occupancy rate has oscillated around and copied the EU decreasing trend.
- Capital formation expenditure is above Visegrad but below Old–EU–MS averages. Expressed as % of GDP, it has been decreasing
- General hospitals drive capital investment
- Assets owned by hospitals managed by the Ministry of Health and budgetary regional, city and municipal hospitals report highest rate of amortization. Overall rate of amortization increases overtime.
- Regional budgetary hospitals report the largest share of equipment which has been aside for long. In the years following the world financial crisis equipment bought lacks behind equipment newly put into operation
- There is a scope for an increase in utilization of selected medical devices

3 Literature review of health care efficiency

There are studies which compare efficiency of healthcare sectors of different countries. Examples include Evans *et al.* (2001), Afonso & Aubyn (2004), or Raty & Luoma (2005), the first of which was repeatedly revisited, e.g. in Greene (2004). A substantial effort to measure efficiency of health sectors of different countries has been done by the OECD (OECD, 2002; Hakkinen & Jourmard, 2007; Jourmard *et al.*, 2008, 2010). Varabyova & Schreyögg (2013) then measures technical efficiency of the hospital sector of OECD countries.

A comprehensive list of international comparative efficiency studies of healthcare systems may be found in EC (2010) which draws on the stock of the available research findings to define general policy recommendations.

The first international comparative efficiency studies have widely been criticized and revisited multiple times. The reason is that **when measuring efficiency, homogeneity of the sample is required**, but cross-country studies tend to be rather heterogeneous due to intrinsic institutional characteristics that determine each particular system (Jourmard *et al.*, 2008, 2010). Different methodologies in measuring inputs and outputs may make international studies quite inaccurate too (OECD, 2002; EC, 2010).

The importance of institutions for international efficiency studies was tackled in Hakkinen & Jourmard (2007). Paris *et al.* (2010) then gathered institutional characteristics of 29 countries, including health service coverage and characteristics of health provision, characteristics of the government and budget of the particular country. Later, Jourmard *et al.* (2010) incorporated institutional analysis of Paris *et al.* (2010) into efficiency analysis. Surprisingly, however, larger differences in efficiency scores were within than between institutional groups which makes it impossible to identify institutions which contribute to better performance of the healthcare system.

Quantitative efficiency analyses thus more frequently concentrate on a particular sub–sector of the healthcare system (hospitals, nursing homes, emergency units, etc.) than healthcare systems as a whole. Such sub–samples are more homogeneous and the results are more accurate.

3.1 Review of general hospital analyses

In the international efficiency literature, general hospitals, as a sub–sector of the healthcare system, have been most frequently quantified (52 % of 317 studies reviewed in Hollingsworth & Peacock (2008) analyze hospitals). The pioneer studies from 1980s tested whether frontier models are appropriate for the healthcare sector (Nunamaker, 1983; Sherman, 1984). After the year 1990, the number of hospitals studies increased remarkably and spread outside the U.S.A. Individual European countries found hospital efficiency analysis also increasingly important. In 2008, an international comparison of hospital efficiency appears (Erlandsen, 2008).

Since Zuckerman *et al.* (1994), researchers often focus on the explanation of the reasons of inefficiency besides pure relative efficiency measurements. When not accounted for, low efficiency scores may be wrongly interpreted as inefficiency even though environmental factors would either have justified lower efficiency scores as reasonable, or, would have pointed out to specific areas for policymakers to target in order to increase efficiency.

The importance of efficiency measurement has been acknowledged also by developing countries. Since 2000, they represent a significant portion of the efficiency literature.

Recently, hospital studies focus in particular on a potential link between efficiency, public/private ownership and the principal–agent problem (Ludwig *et al.*, 2010; Tiemann & Shreyogg, 2011; Busse *et al.*, 2012).

Table A1 provides an overview of selected efficiency studies. More examples may be found of Worthington (2004), Hollingsworth (2008) or Busse *et al.* (2012).

3.2 Variables used in efficiency studies

When measuring efficiency, we are concerned how inputs are converted into outputs. Depending on the type of efficiency (technical/allocative/cost), method of measurement (stochastic/deterministic) and a particular model at stake, **inputs** may be defined in (i) physical units as labor (physicians, nurses, non-medical staff) and capital (number of beds, equipment, etc), or (ii) in monetary terms as total costs which aggregates all inputs into one variable. Sometimes relative costs of inputs, i.e the combination of staff, beds, equipment, etc., are also important to achieve the desired outputs.

Ideally, health **output** should be measured as an increment to patient health status, or as averted deterioration of health because patients do not demand health services per se (Jacobs *et al.*, 2006). However, since this is technically challenging to measure, both cross–country efficiency studies and sector efficiency analyses employ intermediate outputs of various kinds, be it measures of health outcomes (e.g. mortality rate) or activity measures (e.g. discharges).

Specifically, (inpatient) hospital efficiency studies approximate output with (i) the number of admissions/discharges (e.g. Zuckerman *et al.* (1994), Farsi & Filippini (2004) or Hofmarcher *et al.* (2002)) or (ii) the number of inpatient days (e.g. Magnussen (1996)). Some studies (e.g. Chirikos & Sear (2000)) employ the number of inpatient days while distinguishing the day of admission under the assumption that the majority of resources is consumed on the day of admission.

Inpatient output has to be **adjusted for the severity of cases treated**, such as according to the DRG case–mix (Hofmarcher *et al.*, 2002; Vitaliano & Toren, 1996; Farsi & Filippini, 2004; Linna *et al.*, 2006), simple/complex case (Magnussen, 1996) or types of patients treated (Kooreman, 1994). Severity–of–cases adjusted output is then often expressed as a single variable.

Sometimes **quality variables are included among outputs** since care of higher quality increases costs and at the same time weighting by quality increases output. For this purpose, Zuckerman *et al.* (1994) included mortality rates, Vitaliano & Toren (1996) employed a technological index, Frohloff (2007) used doctor/bed and nurse/bed ratia.

Inefficiency determinants describe the environment in which units operate and help **identify sources of inefficiency**. Their choice depends on the particular setting of the analysis. They include for example teaching status (e.g. Rosko & Chilingerian (1999); Rosko (2001)), size (e.g. Yong & Harris (1999); Vitaliano & Toren (1996)), ownership typ (e.g. Zuckerman *et al.* (1994); Rosko (2001); Frohloff (2007)), competition (e.g. Zuckerman *et al.* (1994)), etc.

3.3 What has been done in the Czech Republic

Roubal & Sidlo (2014) compares the number of selected medical procedures carried out across Czech regions finding out large geographic variations particularly for hysterectomy and knee replacement. Deeper analysis of the numbers is however left for further research.

OECD (2011) analyzes efficiency of healthcare spending in light of the total public expenditure and provides policy recommendations. Besides improvement of the DRG payment

system, increased private participation, electronization of the system, active substance drug prescriptions, etc., the Czech Republic should develop a more proactive approach to managing chronic disease and improve overall data infrastructure (OECD, 2011, 2014).

3.3.1 Role of prevention

Even though OECD (2014) acknowledges the emphasis the Czech Republic places on preventive care (e.g. the Czech Republic pioneers programs for colorectal cancer in the world), more could be done in the quality of preventive care. In particular,

1. both professionals and the public should more actively engage in preventive care in order to increase cancer screening programs uptake
2. efficiency of preventive check-ups to which every adult is eligible once in two years should be assessed.
3. Primary preventive programs targeted at the youth and families seem to fail and should be revisited. OECD (2014) is alarmed by the deteriorating youth health statistics - high rates or drunkenness, smoking as well as obesity rates.

Well–targeted prevention decrease the number of acute admissions, decreases the length of stay, decreases rate of re–hospitalization and thus improves efficiency of hospitals and the overall healthcare system.

3.3.2 Czech quantitative analyses

The first attempts to quantify healthcare efficiency in the Czech Republic appeared in Dlouhý (1998), who analyzed a cross–section of 25 long–term care centers. Consequently, Dlouhý *et al.* (2007) and Novosadova & Dlouhy (2007) analyzed a cross–sectional sample of 22 general hospitals in 2003 and a cross sectional sample of 119 hospitals in 2005, respectively. Beside general hospitals, Novosadova & Dlouhy (2007) carried out a separate analysis of 60 long–term care centers. All of these studies used the non–parametric Data Envelopment Analysis (DEA) without accounting for determinants of inefficiency.

A small sample size in Dlouhý (1998) and Dlouhý *et al.* (2007) increases probability that an efficient observation is missing and thus relative efficiency miscalculated. Measures of relative inefficiency which do not account for the reasons for it, miss important explanations which either excuse or blame certain hospitals for low efficiency scores, and fail to bring important background for policy decisions.

Recently, Votapkova & Stastna (2013) estimated efficiency of a panel of 99 Czech general hospitals in 2001–2008 parametrically and Stastna & Votapkova (2014) analyzed a panel of 81 general hospitals in 2006–2010 non–parametrically. Both of these studies aimed at explaining primarily the reasons for inefficiency. The latter took advantage of the DRG case-mix index. These studies represent the most thorough efficiency analyses of the Czech hospital sector.

4 Cost efficiency of Czech general hospitals

This chapter will review findings reached by two recent cost efficiency studies of Czech general hospitals, i.e. Votapkova & Stastna (2013) and Stastna & Votapkova (2014), and will apply these findings for policy purposes focusing on the potential of the DRG case–mix index.

4.1 Differences between available studies of the Czech general hospitals

Both of the studies analyzed a panel of Czech general hospitals. The period of observation and sample size differed due to given constraints - some hospitals merged into larger entities, others did not provide reliable data. Votapkova & Stastna (2013) measured cost efficiency of a panel of 99 Czech general hospitals in the period 2001-2008, while Stastna & Votapkova (2014) analyzed a panel of 81 hospitals in the more recent period 2006–2010. As many as 78 units overlap across studies.

Both studies use frontier methods, but particular models in each of the studies differ. The variety is in line with theoretical literature that suggests that different models should be used to complement each other.

Inputs to both analyses represent total operating costs, excluding capital costs and outpatient costs of hospitals. The vector of variables used as hospital output is however different in the two studies. Votapkova & Stastna (2013) used inpatient days disaggregated into acute and nursing care and did not account for the DRG case-mix index to capture severity of acute care cases which was being developed at the time when the analysis was carried out. Stastna & Votapkova (2014) adjusts acute care admissions for the hospital DRG–case–mix index which takes into account severity of cases treated in each hospital. In addition, Stastna & Votapkova (2014) includes a variable representing publications among outputs to account for the fact that big and teaching hospitals devote some of their productive time to research and teaching rather than just treatment.

Both of the papers explained reasons for inefficiency or pointed at areas which should be targeted for efficiency to increase. However, the set of determinants of inefficiency is different in the two studies. The adjusted vector of output variables in the latter canceled the effect of some of the environmental variables previously used. Similarities and difference between the two studies referenced are summarized in Table 3, a detailed variable description is provided in Table A2 and Table A3.

4.2 How are Czech general hospitals efficient?

When comparing inputs (overall costs) to outputs, including acute days, nursing days, doctor/bed and nurse/bed ratios, in **Votapkova & Stastna (2013)** an average hospital produced very inefficiently **(mean efficiency of 0.411)** as Table 4 reveals. When searching for reasons of such low efficiency scores, Votapkova & Stastna (2013) discovered that if a hospital is either larger (both in terms of the number of beds and the number of patients treated), it is not-for-profit, it is situated in a municipality with a larger share of the elderly or has a teaching status, it tends to be less efficient. On the other hand, hospitals situated in bigger municipalities and in regions where also other general hospitals operate, are more efficient.

Table 3. Differences between Votapkova & Stastna (2013) and Stastna & Votapkova (2014)

Votapkova & Stastna (2013): Efficiency of hospitals in the Czech Republic Prague Economic Papers 4	**Stastna & Votapkova (2014):** Efficiency of hospitals in the Czech Republic - conditional efficiency approach IES WP 31
panel of 99 hospitals	panel of 81 hospitals (78 hospitals overlap)
2001–2008	2006–2010
parametric frontier	non–parametric frontier
inputs = overall inpatient costs	
vector of outputs	
acute days	acute patients adjusted for the DRG–case–mix index
nursing days	nursing patients
doctor–bed ratio	publications among output
nurse–bed ratio	
vector of determinants	
size	specialization
not–for–profit status	not–for–profit status
share of the elderly in a municipality	year 2009
teaching status	year 2010
population in the municipality	salary
competition	

Mean efficiency, when accounting for environmental variables, reached 0.86. Note that when determinants were included into the model, the scores became more homogeneous, i.e. standard deviation decreased.

The results of **Stastna & Votapkova (2014)** discovered average **efficiency** of a sample of 81 general Czech hospitals to be **0.903 and 0.951 for the unconditional and a conditional models, respectively.** Conditioning the efficiency scores on the effect of environmental variables decreased standard deviation of scores, making them again more homogeneous across the overall sample.

The adjustment for the DRG case-mix index (Kozeny *et al.*, 2010) and incorporation of publications among outputs not only **increased average efficiency scores remarkably**, but also turned most of the environmental variables used in Votapkova & Stastna (2013) unimportant. Size of the hospital, teaching status, size of the municipality where the hospital is situated, share of the elderly, neither the number of general hospitals providing care in the same area played a role anymore. **The level of the DRG case–mix index to some extent correlates with specific hospital characteristics.** For instance, DRG case–mix index of the group of big hospitals, which are comparatively more involved in research and are usually situated in significantly larger municipalities with more competing

general hospitals[3], strongly exceeds the DRG case–mix index of hospitals of other sizes. The difference in the DRG case-mix among hospitals is caused both by the different DRG base, i.e. different hospitals tend to treat different types of cases, and differences within DRG groups, i.e. the cases hospitals treat differ also in severity, not only in the main diagnosis. For instance, heart transplant is carried out only in specialized centres/teaching hospitals, not in small hospitals. Hernia surgery is carried out carried out both in big and small hospitals, but teaching hospitals report more complicated cases of hernia as opposed to small hospitals which treat just the simple ones. **An alternative to the DRG mechanism would thus look at local demographics, size, mission and legal form of the institution but at significantly higher costs than the DRG system.**

The effect of the not–for–profit ownership status in Stastna & Votapkova (2014) turned favorable to performance, however significant at one tail only, i.e. the effect is not very profound. The effect is caused by **big/teaching hospitals which are usually not–for–profit** and are involved in research, thus **report a higher publication output**, and also **treat more complicated cases**, i.e. report higher main output as well (which open them research questions or enable them to apply results of the research). A similar explanation is likely to hold for a significant and favorable effect of the presence of a specialized center in a hospital - hospitals with specialized centers report higher publication outputs and, they may also treat more complicated cases - thus tend to be more efficient than other hospitals. However, as much as 5 % of inefficiency on average still remains unexplained.

4.2.1 What is the effect of size?

Size revealed a strong and significant **effect on efficiency scores in Votapkova & Stastna (2013). It was found that the bigger the hospital is, the lower is its efficiency score both when determinants were accounted for and without determinants.** In the baseline model - the scores ranged from 0.55 for small hospitals to 0.24 for big hospital for the baseline model; the model with determinants reported average efficiency scores of 0.95 for small hospitals and 0.72 for big hospitals. When the resulting efficiency scores were divided into size groups, standard deviation in all groups decreased with respect to the overall sample, suggesting **homogeneity within size groups**. For the group of small and medium hospitals, standard deviation of efficiency scores decreased remarkably when determinants were included. **The group of big hospitals, including also 11 teaching hospitals, reported the lowest within group variation in the baseline model (0.077), but the largest variation in the model with determinants (0.121)** across groups. Note also that as opposed to the group of small and medium hospitals, standard deviation increased when determinants were included. The results, on one hand, suggest that it would be a mistake not to account for environmental variables responsible for/justifying inefficiency in Stastna & Votapkova (2014). On the other hand, the rise in the standard deviation among efficiency scores within the group of big hospitals in the model with determinants reveals that there are likely to be other environmental variables justifying/causing low efficiency scores which need to be searched for. Note also that the large dispersion of efficiency scores among big hospitals

[3]The share of the elderly in the municipality is comparable across hospitals in the sample.

in the environmental model is caused by the fact that **all 11 teaching hospitals belong to this group and reach 11 lowest efficiency scores, not exceeding 0.7 which is the mean for the group of big hospitals with determinants.**

In **Stastna & Votapkova (2014)**, even though not significantly, one also observes a pattern when efficiency scores are divided into size group. However, here **efficiency scores increase with an increase in size both for conditional and unconditional models which is attributed to the incorporation of the DRG–case–mix index and publications among variables.**

Standard deviation between unconditional and conditional models decreased for all size groups, consistent with the overall sample. The most homogeneous results were found in the group of big hospitals, both for the conditional and unconditional models contrary to the models in Votapkova & Stastna (2013) in which the group of big hospitals revealed the largest standard deviation across groups due to, primarily, the presence of teaching hospitals. On the other hand, the largest standard deviation of scores is observed for the group of small hospitals, for both conditional and unconditional models, again contrary to Votapkova & Stastna (2013) which reported the lowest standard deviation for small hospitals for both models. The most profound decrease in heterogeneity between the unconditional and conditional models was found within the group of medium hospitals, consistent with Votapkova & Stastna (2013).

The remarkable increase in average efficiency scores for big hospitals and a decrease in standard deviation of scores within this group between the unconditional and conditional models is explained by the improved vector of outputs in Stastna & Votapkova (2014). It suggests that **big and teaching hospitals indeed tend to treat more complicated cases and carry out research besides treatment, which is the main function of hospitals.** Also other hospitals (small and medium ones) that do research and publish their findings differentiate from those that just treat, which is supported by the large standard deviation of efficiency scores among the group of small hospitals. Big and teaching hospitals are also more often not–for–profit than hospitals of other sizes.

A robustness check in Stastna & Votapkova (2014), where the sample was divided into two subgroups, i.e. big hospitals; and small and medium hospitals, confirms that big hospitals are responsible for the significant effect of the not–for–profit ownership status in the aggregate analysis. The effect of **not–for–profit ownership proved favorable to relative efficiency scores of the group of big hospitals, contrary to the group of small and medium hospitals where the effect of this variable was negative**. The disaggregated analysis further revealed that **big hospitals, as opposed to small and medium ones, took some cost–saving measures in 2010 as a response to the world financial crisis** since their average efficiency in 2010 slightly increased[4]. This effect was not found either for the overall sample, or for the group of small and medium hospitals.

4.3 What do we conclude from the analyses?

Not accounting for the DRG–case–mix index and publication outputs would be a mistake that results in big and teaching hospitals being more inefficient than they actually are, relative

[4]Subsidies received from the founder stayed approximately at the same level (Figure A1)

to small and medium hospitals. Big and teaching hospitals often treat complicated cases and besides treatment, devote a portion of their productive time to research. As a result in Votapkova & Stastna (2013), big and teaching hospitals were least efficient.

However, in Stastna & Votapkova (2014) when DRG adjusted and publication outputs were considered, big and teaching hospitals were most efficient relative to the rest of the sample. Comparison of the two studies suggests that **big and teaching hospitals should be funded separately from small and medium ones.** If funded based on the same scheme, there will always be either group or the other disadvantaged.

The disaggregated analysis further suggests that **small and medium hospitals may potentially benefit from corporatization.** However, a deeper investigation of the setting of each hospital would be desirable before corporatization could be set as a general goal. In addition, **big hospitals proved to be more financially flexible** than small and medium ones in their present set-up.

The DRG–case–mix adjustment and incorporation of publication output, took up on themselves the effect of most of the environmental variables previously used. The DRG case-mix index thus captures both severity of cases and the structure of patients treated.

Cost efficiency of Czech general hospitals - core message:

- DRG case–mix index and publications decrease variation across efficiency scores
- DRG case-mix index captures both the severity of cases and the structure of patients treated
- Big and teaching hospitals should be financed according to a different scheme than small and medium ones
- Small and medium hospitals may benefit from corporatization but a detailed examination of each particular hospital setting would be desirable
- Big and teaching hospitals are more financially flexible in the current set-up

5 DRG system and potential for its improvement

The **DRG system** in the Czech Republic is still a **relatively new** phenomenon, thus there is still much to improve. The following text will discuss the development of the current DRG system, its potential for benchmarking of hospitals and efficiency improvements, as well as the drawbacks of the system.

5.1 History

Research on the DRG started in the second half of 1990s, advanced substantially with the foundation of the National Reference Center (NRC) in 2003, however, the system was not implemented as a payment mechanism until **2007**. Since then, case payments based on

Table 4. Summary of efficiency scores

	whole sample				small			
	Votapkova & Stastna (2013)		Votapkova & Stastna (2014)		Votapkova & Stastna (2013)		Votapkova & Stastna (2014)	
	baseline	with determinants	unconditional	conditional	baseline	with determinants	unconditional	conditional
min	0.112	0.501	0.449	0.528	0.373	0.982	0.449	0.528
max	0.931	0.997	1.325	1.004	0.914	0.997	1.325	1.004
mean	0.411	0.863	0.903	0.951	0.590	0.993	0.883	0.926
median	0.379	0.866	0.935	1.000	0.558	0.993	0.910	1.000
st. dev.	0.192	0.133	0.145	0.104	0.145	0.004	0.187	0.134
effficiency ≥ 1	NA	NA	13	2	NA	NA	8	1
effficiency ≥ 1.1	NA	NA	3	0	NA	NA	1	0
effficiency ≥ 1.2	NA	NA	2	0	NA	NA	1	0
effficiency ≥ 1.3	NA	NA	1	0	NA	NA	1	0
hospitals	99	99	81	81	33	33	29	29
	Medium				Big			
	Votapkova & Stastna (2013)		Votapkova & Stastna (2014)		Votapkova & Stastna (2013)		Votapkova & Stastna (2014)	
	baseline	with determinants	unconditional	conditional	baseline	with determinants	unconditional	conditional
min	0.112	0.809	0.628	0.637	0.113	0.501	0.659	0.766
max	0.931	0.982	1.247	1.003	0.379	0.898	1.082	1.000
mean	0.399	0.875	0.898	0.956	0.243	0.722	0.933	0.976
median	0.379	0.863	0.912	1.000	0.260	0.789	0.972	1.000
st. dev.	0.153	0.038	0.131	0.095	0.077	0.121	0.088	0.054
effficiency ≥ 1	NA	NA	3	1	NA	NA	2	0
effficiency ≥ 1.1	NA	NA	2	0	NA	NA	0	0
effficiency ≥ 1.2	NA	NA	1	0	NA	NA	0	0
effficiency ≥ 1.3	NA	NA	0	0	NA	NA	0	0
hospitals	33	33	27	27	33	33	25	25

DRGs have been a means of reimbursement mechanism for inpatient healthcare services (together with global budget, individual contracts between health insurance funds and healthcare providers and fee for service payments). According to the expert estimates of the Ministry of Health of the Czech Republic, as much as **85 % of hospital reimbursement was done through the DRG in 2013.**

At first the Czech Republic contemplated implementing the AP-DRG classification system, however after the foundation of the NRC, the license on IR-DRG system was purchased and now the Czech healthcare system uses the **IR-DRG** classification system exclusively, which is modified for the Czech healthcare environment.

5.2 How does it work now?

The current version of the Czech IR-DRG grouping system contains **366 base groups** and most of them are divided into three severity levels - major complications and comorbidities (MCC), complications and comorbidities (CC) and without MCC/CC, thus there is a **total of 1,046 groups in 2014.** Moreover, NRC updates the DRG groups for their relative weights every year. The DRG relative weights, which indicate the average relative amount of expenses associated with the treatment of patients within a given DRG group, are mainly based on cost data that hospitals provide to NRC on a voluntary basis. The DRG cost weights are calculated for (i) normal cases which are between limits (inliers), (ii) higher or lower payments for extreme cases with longer or shorter lengths of stay or (iii) cases requiring higher or lower material costs.

In 2014 the base payment rate, that after multiplying by the relative weights determine the level of reimbursement, **is the same for all hospital.** However, so called **"risk corridors"** were established which ensure that reimbursement of the hospital cannot drop below a threshold level (in 2014 threshold is set to 97% reimbursement of the year 2012) or it cannot exceed a given upper limit (in 2014 limit is set to 150% reimbursement of the year 2012) when hospital fulfill certain volume of case–mix, which is calculated from the data from the reference year.[5]

5.3 Specifics of the Czech DRG system

Hospital care in the Czech Republic is divided into three parts: (i) acute care and (ii) other hospital services such as aftercare treatment, rehabilitation, outpatient care etc, and (iii) day cases. **Only acute care is financed through diagnosis-related group (DRG)**. Other hospital services are reimbursed through per day payments or fee for services payments. Day cases, as a category of its own (see section 7), stand between inpatient and outpatient care and are reimbursed through fee for services.

DRG reimbursement system for acute care is set in the Czech legislation. The NRC is responsible for data collection, DRG cost weights calculations and development and publi-

[5]Consider a hospital that produces a required case mix, which if multiplied by the base payment rate, would guarantee only 90 % of reimbursement of 2012. Such a hospital receives more money (97% reimbursement of the year 2012) than if reimbursed by the DRG base payment rate. The narrower the "risk corridor" the fewer hospitals are reimbursed by the actual DRG system, but rather are reimbursed by a lump–sum payment.

cation of the methodology. **The input data for calculating DRG cost weights,** which are transferred to the NRC, **come from all health insurance funds and participating hospitals ("reference hospitals").** Health insurance funds provides detailed information about all hospital cases and the reference hospitals share their accounting data (costs and revenues). Participating hospitals have to adjust their cost-accounting so that all costs are precisely entered into particular cost group.

All procedures performed, drugs, blood and medical devices used, external laboratory tests outsourced, capital, operating and overhead costs expended - all are covered in the cost of the case to calculate DRG relative weights. Operating and overhead costs are allocated to cases in the amount of per diem costs. **Teaching, research and development expenditures**, that are also related to the case, **do not affect the calculation of the DRG relative weights**, consistent with practice in other countries (Busse *et al.*, 2011). Teaching, research and development costs are financed throught public funds.

Besides public hospitals, some costly capital investment in private hospitals in the Czech Republic is also financed through public fund. There arises a question, whether capital investments should be included or not in the DRG system. Busse *et al.* (2011) highlight that including capital costs in DRG weights leads on one hand to stronger incentives to reorganize care and concentrate better technological innovations in specialized hospitals with large numbers of patients. On the other hand, it may prevent access to services in poorly populated rural areas with smaller hospitals which carry out less technologically demanding interventions. Whether include capital costs into the DRG thus depends on the objective of the particular healthcare system. **For example Austria, Finland, Germany and Ireland exclude capital costs from the computation of the DRG weights**, while other countries include it (Busse *et al.*, 2011).

DRG system in the Czech Republic:

- Czech DRG system is based on historical reference cost
- Only acute care is financed through diagnosis-related group (DRG) and other hospital services are paid through per day payments or fee for services payments
- Day cases are reimbursed through fee–for–service, it is not included into the DRG system
- Input data to calculate DRG relative weights include cost of procedures, other medical costs (drug, blood, medical devices, outpatient costs, material, anesthesia, surgery, etc.), accounting data (operating and overhead costs such as laundry, catering, cleaning services etc.) and capital costs. Operating and overhead costs are allocated to cases in the amount of per diem costs.
- DRG system in the Czech Republic include capital investments, but exclude teaching and R&D cost which are financed through other sources (grants, subsidies, etc.)

5.4 Potential of the fully functioning DRG system in the Czech Republic

The potential of the fully functioning DRG system may be divided into three categories:

5.4.1 Increase in efficiency

Within the DRG system, the payment for equal inpatient care is set to the optimal level, regardless of the length of stay. However, costs rise with every additional inpatient day for which a provider is no longer reimbursed. The main potential of the implementation of the DRG is thus to **shorten the excessive length of stay**, which should lead to an **increase in efficiency** without a decrease in the quality of healthcare, holding day-case substitution and readmission rates constant.

Reduction in the average length of stay is one of the proven effects of the introduction of the DRG reimbursement system abroad. Cheng *et al.* (2012) in their study about impacts of DRG payments on health care in Taiwan determined that the introduction of the DRG payment system significantly decreases the length of stay. Louis *et al.* (1999) found the same effect in Italy - the mean length of stay decreased from 9.1 days to 8.8 days. Besides, Italian hospital admissions decreased as well. The same effect is expected to have partly taken place in the Czech Republic. The average acute care length of stay has been decreasing continuously over the past years - in 2009, it was 7.1 days which decreased to 6.8 in 2011 (Figure 10, OECD (2000–2012)). However, Rosenberg & Browne (2001) argue that decreasing average length of stay is consistent with a general trend, regardless of the DRG introduction.

5.4.2 Improvement in benchmarking of hospitals

Despite savings both at micro and macro level, the DRG system significantly **improves benchmarking of hospitals** as shown in section 4. When not accounting for the DRG case–mix index in the efficiency analysis, hospitals providing highly specialized care which consumes more resources would be disadvantaged. On the other hand, efficiency of hospitals which produce just general care but consumes more resources than necessary would be inflated.

5.4.3 Effective and fair financing of diversified units

Comparision of the results of the two analyses in section 4 implies that a set–up **alternative to the DRG system would look at local demographics, size, mission and legal form of the institution** to correct funding which can be directly captured through the case–mix approach. **DRG system thus bears lower administrative costs in the long run**, once fully and effectively functioning.

Potential of the fully functioning DRG system:

- Fully functioning DRG system increases efficiency of hospitals, simplifies hospital benchmarking and lowers administrative costs of hospital financing
- Alternative to the case–mix approach is a system which looks at local demographics, size, mission and legal form of hospitals, but with higher administrative costs

5.5 Drawbacks of the Czech DRG system and potential for their improvement

Section 4 stressed a huge importance of the DRG case–mix index for financing of hospitals even at the current set–up. However, the present case–mix system still suffers from **major drawbacks** which need to be addressed in order for the Czech Republic to take advantage of the full potential of the DRG reimbursement system. These include:

- **Individual payment rates**
- **Small sample of reference hospitals to set the optimal cost of cases**
- **Insufficient homogeneity within DRG groups**
- **Upcoding, unbundling and coding fraud**
- **Research and development**

5.5.1 Individual payment rates

Although the Czech DRG system has currently a flat payment rate, different level of reimbursement for the same service resulting from the establishment of the "risk corridors" cause that **each hospital has a different real payment rate**. Slightly different payment rates are natural for highly specialized and diversified care, but the individual payment rates unfortunately escalated so much that even exactly the **same care** is sometimes **reimbursed differently** for hospitals of the same type, which is inconsistent with the idea of the DRG system. With such a system, there is no pressure to sufficiently reduce the costs of health care services.

Solution:

Individual base payment rates should gradually **converge to a flat rate** and "risk corridors" should be abolished or widened. "Risk corridors" will then be used only in utmost reasonable cases to distinguish different types of care However, in the current setup, just a flat rate for all hospitals is insufficient because existence of some hospitals would be threatened. Individual payment rates which are gradually phased out give time to the inefficient units to adapt their management and increase efficiency till a given deadline, otherwise, they would go immediately bankrupt and would have to be closed down.

5.5.2 Small sample to set optimal cost of cases

The second problem is related to the cost data used for computation of the relative weights. Data are provided on a voluntary basis, which actually means that **only 12 hospitals provide data every year.** Although reference units include a portfolio of teaching hospitals, specialized hospitals, large contributory hospitals and also smaller hospitals, this sample is

too small to be representative of all 156 acute care hospitals operating in the Czech Republic. If the relative weights to find optimal costs are set incorrectly, and there are, for example, some DRG groups, which systematically underestimate or overestimate production, hospitals may start to select patients who belong to economically profitable DRG groups.

Solution:

A solution would be to legislatively set a **reporting obligation for all hospitals.** If there are more hospitals in the reference group, the relative weights will reflect real costs and set the correct level of reimbursement which hospital should receive for treatment of a given group of the patients.

5.5.3 Insufficient homogeneity within DRG groups

Another drawback partly relates to the previous one. **DRG groups** should be **clinically and economically homogeneous.** This target is not yet fully achieved in the Czech Republic due to (i) a small number of reference hospital which provide cost data and (ii) the fact that the DRG system in the Czech Republic is still relatively new and thus not yet optimal. In the worst scenario, it may thus happen that an insufficiently homogeneous DRG group which was assigned an incorrect relative weight and base rate does not guarantee an optimal and correct level of reimbursement which a hospital should receive for treatment of a particular group of the patients.

Solution:

Homogeneity within DRG groups should increase if **additional groups are introduced** and the whole system thus more precisely reflects clinical and economic aspects of the cases treated. **However, the number of DRG groups should be limited** because each group has to contain a sufficient number of hospital cases to calculate the optimal relative weights.

5.5.4 Upcoding, unbundling and coding fraud

The problems of upcoding, unbundling and coding fraud are also common to other countries using the DRG system. **Upcoding** means that a hospital **selects incorrect DRG codes to obtain higher reimbursement** - they change the principal diagnoses or select specific secondary diagnoses, which cause that relative weights increase. Within **coding fraud, diagnoses which could be treated as day cases not reimbursed with a DRG, may be classified as inpatient care** and patients stay in the hospital longer than necessary. **Unbundling** means that a hospital **interrupts the treatment only for the purpose of higher revenues** and, if member of a holding, transfers a patient to another hospital with the same owner to earn higher profit.

Solution:

These problems should be solved by **clearly set coding rules** after DRG groups have been precisely defined. **Strict penalties** will then discourage hospitals from upcoding, unbudling and coding fraud.

5.5.5 Research & Development

Comparison of the Votapkova & Stastna (2013) and Stastna & Votapkova (2014) suggest that besides the DRG, R&D proxied by publications has a significant explanatory power as an output variable when measuring efficiency.

Solution:

Including R&D as an input to the calculation of relative DRG weights may be desirable, depending on the objective of the Czech healthcare system (similar to capital - see discussion of incorporation of capital costs in subsection 5.3 and subsection 6.3).

In 2014, DRG responsibilities of the NRC are transferred to the Institute of Health Information and Statistics of the Czech Republic and a new phase of implementation of DRG system starts with a new project called **"DRG restart"**. The goal of the project is to implement a new DRG system **until 2017**, which should **correct all** the above-mentioned **shortages.**

Potential for improvement of the Czech DRG system:

- Individual base payment rates should start to gradually converge to a flat rate.
- It is necessary to obtain costs data from more reference hospitals to identify homogenous DRG groups and set optimal relative weights.
- Upcoding and unbundling can be solved by better definition of DRG groups and a functioning system of penalties for cheating.
- R&D may be incorporated into the calculation of the DRG weights, depending on the objective of the system.

6 Capital expenditures of hospitals

6.1 Regulation of purchases of capital

Until April 2014, there were no standards or regulations for hospitals on how to finance and purchase individual pieces of equipment. It was the responsibility of the health care provider to decide what to buy. Hospitals themselves then contracted with health insurance funds upon reimbursement of treatment using the equipment bought.

In April 2014, the Equipment Commission was established, which assesses medical and economic efficiency of "hard" equipment[6]. The Commission analyzes necessity of the equipment with respect to the entire Czech Republic or region, and also availability of after–care treatment neccessary after the intervention within the particular hospital and immediate neighborhood hospitals. The commission calculates how much the intervention using the equipment will cost the healthcare system as a whole and what benefits it will bring both to the patient and the system.[7] **The commission then either recommends or disapproves purchase of the equipment.** Health insurance funds agreed to respect the decision of the commission[8] and not to reimburse procedures carried out with equipment disapproved by the commission. **Establishment of the equipment commission thus prevents over–priced, inefficient and unnecessary purchases.**

6.2 Corruption in capital purchases

Based on 2013 field interviews, EC (2013) reports that corruption in certification and procurement of medical equipment was a serious problem in the Czech Republic (score 4.25/5 with 5 being very serious). With the inflow of available EU money, the price of medical equipment further increased by 15–30 % on average (EC, 2013). An investigative spot on Czech television, Reporteri CT (2014) found out that equipment purchases cost on average 30 % more than what they should because hospitals buy equipment through intermediaries rather than directly from the producers.

Besides the equipment commission, **a remedy to corruption is a well–functioning case-mix reimbursement mechanism.** When hospitals receive a fixed payment per case, which includes also capital costs (see subsection 5.3 and subsection 6.3), **hospital management is** disincetivized from corruption and is **motivated to negotiate the best possible price.** In other words, if an overpriced machine is bought, (i) it is not recommended by the equipment commission and thus should not be reimbursed by insurance funds, (ii) if it is for some reason reimbursed, the cost of corruption is absorbed by the hospital itself, rather than by the insurance company if reimbursed through the case–mix mechanism. In the future, when DRG reimbursement mechanism effectively functions and the equipment commission is well–rooted within the healthcare system, corruption in capital purchases should disappear.

6.3 Capital costs as a part of the DRG system

Capital costs are included in the Czech DRG relative weights (for further discussion see subsection 5.3). Even though most countries do so, there are exceptions which do not consider capital costs as inputs to the case–mix calculations - e.g. Austria, Finland, Germany, Spain and Ireland.

Whether countries include capital costs into the DRG depends on the objective of the particular healthcare system. If reorganization of care is the goal resulting in fewer

[6] These include magnetic resonance imaging, computer tomography, linear particle accelerators, angiographic lines, etc. It does not include frequently used equipment such as EKG, etc.

[7] Although, it is not an HTA analysis.

[8] Although health insurance funds are not legally obliged to respect the decisions of the commission.

specialized centers with large–scale equipment usually in more densely populated areas, then capital is included into the DRG. However, if the objective is to achieve equal accessibility of service across the country, including poorly populated areas, capital costs are excluded (Busse *et al.*, 2011).

When capital costs are not included in the case–mix system, there arise a number of potential risks. They are not topical, however, when hospitals are reimbursed for capital costs otherwise. Once the DRG payment system functions optimally and hospitals are reimbursed for capital costs either within the DRG or otherwise, none of these risks should be a problem.

1. Risk of inflating care volumes

In order for capital costs to be paid for, providers of inpatient care may be motivated to inflate the volume of care provided. For instance they may report multiple capital–free interventions, even though the single intervention was carried out using medical equipment.

2. Risk of upcoding

In order to be reimbursed for capital costs, providers may upcode the intervention provided, i.e. they may classify it under a different DRG with higher reimbursement. The provider may change the primary diagnosis or select a secondary diagnosis. For further discussion of upcoding see subsubsection 5.5.4.

3. Risk of shifting technological interventions out of inpatient episodes

Alternatively, providers may be motivated to shift technological interventions out of inpatient episodes, the reimbursement for which covers capital costs. They may artificially quit hospitalization and provide outpatient care if reimbursement for outpatient interventions cover capital costs. Subsequently, the patient may be re–admitted for hospitalization. Such a fraud then also artificially increases re–admission rates, thus causing further statistical inconsistency.

6.3.1 Problems of the Czech DRG set–up

Capital costs of all Czech hospitals are reimbursed within the DRG payments. Besides, **state, regional, municipal and city (both budgetary and corporatized) hospitals receive investment subsidies**, however, private hospitals do not receive any additional money. Public hospitals are thus reimbursed for capital costs twice.

Multiple scenario may make the system more efficient:

- once the DRG system functions optimally, abolish investment subsidies for public hospitals
- introduce two sets of case–mix relative weights, one for public hospitals receiving subsidies; and one set for private hospitals. The system of double relative weights is usual in other European countries, e.g. France.

Capital expenditures of Czech hospitals:

- Equipment commission and a well–functioning DRG reimbursement system prevents over–priced purchases of medical equipment
- Czech case–mix system includes capital costs
- If capital costs are not included within the DRG, a number of potential threats arises (e.g. inflating care volumes, upcoding, shifting interventions out of inpatient care)
- In the current set–up publicly–owned hospitals are reimbursed for capital costs twice - within the DRG and in investment subsidies, while capital costs of private hospitals are paid for only through the DRG. As a solution, either abolish state subsidies; or introduce two sets of relative weights

7 Day care interventions

This chapter will analyze day care interventions in the Czech Republic, which take up - compared to other EU countries - a considerably smaller share of all interventions (see Figure 14).

7.1 Definition

Day care denotes hospitalization for less than 24 hours during which a planned surgery is carried out. In the Czech Republic, it is classified as a **specific category of health services,** independent of either inpatient care or an ambulatory care (Health Service Act 372/2011 [Zakon o zdravotnich sluzbach a podminkach jejich poskytovani]).

Daycare is reimbursed through fee–for–service, similar to ambulatory care, covering among others also capital costs.

Day care may be **offered by both inpatient and outpatient facilities** if hygienic, technical and personnel conditions are met. If offered by an outpatient provider, it is stipulated that an **inpatient facility** has to be **reasonably accessible** in case follow-up complications occur.

7.1.1 Daycare abroad

As opposed to the Czech Republic, which classifies daycare independent of inpatient care, many countries expanded the concept of the DRG for day care, e.g. Finland, France, Ireland, the Netherlands and Sweden. Busse *et al.* (2011) highlight that countries have either extended their patient classification system for day care or set different relative weights for day cases.

Ireland as well as Finland, France, the Netherlands and Sweden included day cases into DRG system by creating new DRG groups for day care. Based on the notion that the "the like should be compared with the like", Ireland aims at defining and coding services by reference to the episode of care, i.e. diagnosis, and not by reference to care setting, i.e. as inpatient, outpatient, daycare, etc. (An Roinn Slainte, 2014).

In Austria, England, Germany and Poland, as opposed to Ireland etc., relative weights are adjusted for day cases, thus reimbursed through the DRG, even though not officially being part of the DRG process. (Busse *et al.*, 2011).

When day cases are included within the DRG, the countries often identify them as having no length of stay. Incorrect identification may result and hospitalizations other than just those during which a planned surgery was carried out, may be included. **Day cases should thus rather be identified according to the treatment setting than the length of stay**.

7.2 Day care in numbers

The Czech Republic collects **data on day care** with a unique ID **only since 2012,** Prior to 2012, only hospitalizations shorter than 24 hours were recorded, which include both day care interventions and hospitalizations originally planned for longer than 24 hours, which were shortened due to various reasons (initial examinations show no need of further hospitalization, a patient is transferred, a patient signs up a requirement for ealy leave, death, etc.).

In 2012, 1,751 interventions were officially recorded as **day care** (Table 5) in the Czech Republic, 399,533 hospitalizations report the length of hospital stay of one day, i.e. they may have lasted overnight and even less than 24 hours since the day of admission and release count as 1 inpatient day, 207,273 hospitalizations did not exceed 24 hours[9]. When considering just those hospitalizations which started and finished on the same day, the year 2012 reports 89,415 cases. When further restricting the sample to admissions which started and finished on the same day and were released only for home, 62,415 cases are reported (Institute of Health Information and Statistics of the Czech Republic, 2010–2012). In Table 5, one notices an increasing trend in the share of short–term hospitalizations on the total number of hospitalizations, regardless of the methodology taken.

Table 5. Day care vs. hospitalizations under 24 hours

	Discharges					
	Total	day cases	1 day hospitalizations	up to 24 hours hospitalizations	admission and release the same day	admission and home release the same day
(a)	(b)	(c)	(d)	(e)	(f)	(g)
2010	2,363,169	NA	367,557	184,890	75,606	49,648
2011	2,331,697	NA	379,802	193,894	82,253	55,834
2012	2,330,406	1,751	399,533	207,273	89,415	62,415

Source: Institute of Health Information and Statistics of the Czech Republic (2010–2012)

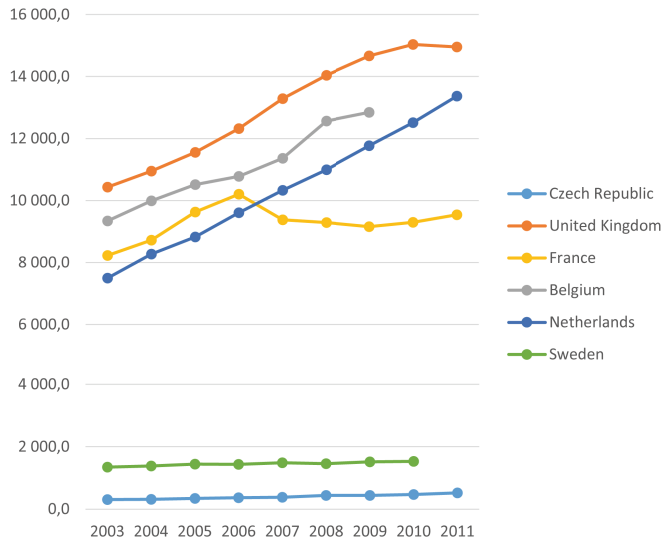
Also EUROSTAT (2003–2012) in Figure 14 reveal an increasing trend in the number of day cases per 100 000 inhabitants in recent years, however, the definition of day cases probably differs from the Czech official definition. Exact definition of a day care intervention used by Eurostat was not found. Most probably, Eurostat considers all admissions which started and finished on the same day and were released only for home as day cases.[10] Table A4

[9]However, there are 154,624 outliers in the dataset 2010–2012 which report the time of release at 00:00 which cannot be the case in reality.

[10]Recalculating data from Figure 14 by the exact number of inhabitants in each each, we get approx. data

adds the number of day cases for selected diagnoses for 2010 as defined by Eurostat. For all diagnoses, the Czech Republic reports the lowest number per 100 000 inhabitants compared to EU averages.

Figure 14. Day cases per 100 000 inhabitants



Source: EUROSTAT (2003–2012)

Note: In 2012, the Czech Republic reported 10.52 mill inhabitants.

7.3 Why is hospitalization more frequent than day care?

Most frequently, day-case surgeries are carried out on a **knee joint** (more than 35 % of all day cases), however, classified as different main diagnoses (Institute of Health Information and Statistics of the Czech Republic, 2010–2012). The diagnosis with most recorded day cases counts as many as 241 day-case interventions, which is about a quarter of all interventions for the particular diagnosis (M2323 as of MKN-10 classifications). The number of day care interventions for other diagnoses decreases significantly (Table 6).

Descriptive statistics in Table 7 suggests that the patients diagnosed with M2323 undergoing day care are on average 4 years younger than those being hospitalized and in most cases when a patient is admitted into a hospital, one's health conditions require further/follow up care, as opposed to patients undergoing day care interventions, none of whom needs a follow–up care. Descriptive statistics for other diagnoses (upon request from the authors) also suggest the **need of a follow–up care to explain preference for hospitalizations to day care interventions.**

Substitution effect between certain DRGs and day case diagnoses may also be

in column (g) of Table 5.

Table 6. Most frequent day–case diagnoses, CZ, 2012

ICD 10	Diagnosis	**Day cases**
M23.23	Internal derangement of knee-Derangement of other medial meniscus due to old tear or injury	241
M23.20	Internal derangement of knee-Derangement of unspecified meniscus due to old tear or injury	171
M23.90	Internal derangement of knee-Unspecified internal derangement of unspecified knee	156
I83.9	Asymptomatic varicose veins of lower extremities	152
K40.9	Unilateral inguinal hernia, without obstruction or gangrene	103
K80.2	Calculus of gallbladder without cholecystitis	74
K42.9	Umbilical hernia without obstruction or gangrene	70
M75.1	Rotator cuff tear or rupture, not specified as traumatic	46
M23.50	Internal derangement of knee-Chronic instability of knee-unspecified knee	34
M72.04	Fibroblastic disorders-Palmar fascial fibromatosis [Dupuytren]-Hand	34
M65.34	Synovitis and tenosynovitis-Trigger finger-Hand	33
M20.1	Hallux valgus (acquired)	32
M23.91	Internal derangement of knee-Unspecified internal derangement of right knee	29
G56.0	Carpal tunnel syndrome	28
K80.1	Calculus of gallbladder with other cholecystitis	27
N84.0	Polyp of corpus uteri	24
M17.0	Bilateral primary osteoarthritis of knee	23

Source: Institute of Health Information and Statistics of the Czech Republic (2010–2012)

an explanation. Specifically, diagnoses which are treated as daycare in some hospitals may be classified as inpatient care in other hospitals. Note that both DRG and fee–for–service payments cover capital costs. Capital costs are thus not a reason for substitution from daycare. Furthermore, if classified as inpatient care instead of daycare, some cases may be **treated longer than necessary**. There needs to be an **agreement on a specific list of daycare interventions** to prevent unnecessary substitution, coding fraud.

In order to find the specific reason why some cases are treated as day care, while others require hospitalization, a sophisticated econometric analysis would be necessary. Such an analysis would again have to be performed diagnosis-wise due to large heterogeneity among diagnoses.

In the future, the **number of** short term hospitalizations, **day cases** in particular, **is expected to increase** in the Czech Republic. Given the improved statistical reporting which started in 2012, **efficiency analysis** for day care interventions would **then** reveal important

policy implications.

Table 7. Descriptive statistics M2323, 2012

	Age	Days_ICU	LOS	ICU	sex	re_intervention	compl.	infection	further_care
					Hospitalizations				
mean	46.240	0.007	2.385	0.007	0.559	0.003	0	0	0.990
median	46	0	2	0	1	0	0	0	1
min	13	0	1	0	0	0	0	0	0
max	83	1	38	1	1	1	0	0	1
st.dev	14.710	0.081	2.064	0.081	0.497	0.051	0	0	0.102
obs.	766	766	766	766	766	766	766	766	766
					Day cases				
mean	42.855	0	1	0	0.552	0	0	0	0
median	42	0	1	0	1	0	0	0	0
min	14	0	1	0	0	0	0	0	0
max	80	0	1	0	1	0	0	0	0
st.dev	15.924	0	0	0	0.497	0	0	0	0
obs.	241	241	241	241	241	241	241	241	241

Source: Institute of Health Information and Statistics of the Czech Republic (2010–2012)
Note: Days_ICU = days at intensive care units, LOS = Length of stay, ICU = dummy 1 if at the ICU at all, sex = dummy 1 for male, re–intervention = dummy 1 if re–intervention, compl. = dummy 1 if complications occured, infection = dummy 1 if infection occurred, further_care = dummy 1 if further care was needed

Day care:

- Daycare is a unique category of healthcare services, separate from inpatient and ambulatory care. It is reimbursed through fee–for–service payments, similar to ambulatory care.
- Knee joint surgery is the most frequent day case intervention.
- Need for follow–up care, substitution effect between DRGs and daycare diagnoses and upcoding seem to explain preference for hospitalizations to day care interventions but an econometric analysis is yet to be done.
- Even though not a very wide–spread phenomena yet, increasing trend in the number of short–term hospitalizations and daycare represents a potential for the future efficiency analysis of day care interventions.

8 Conclusions and recommendations

The paper analyzed efficiency of the Czech healthcare system. Having introduced the stylized facts of the Czech Healthcare system as a whole, it largely concentrated on inpatient care respecting the notion that in order to target specific sources of inefficiency, a micro level

analysis of individual players in the system has to be carried out.

Comparison of selected indications of the Czech healthcare system with other EU countries in Section 2 revealed that **the Czech Republic is at the fore with the share of public participation on healthcare expenses.** The only private source of financing are out–of–pocket contributions by the patients - **any private insurance plan is absent,** whatsoever.

Despite a steady decrease in inpatient discharges per capita, the number of hospital admissions is still the highest among all EU countries which explains why **the Czech Republic devotes a significantly larger share of healthcare resources to inpatient care** than even the Visegrad countries. A positive trend in the **decrease of the acute care length of stay** in recent years is appreciated, however, there still seems to be a scope for its further decrease, given a not yet fully functioning DRG reimbursement system. By the same token, the Czech Republic should still continue **increase places of long–term care**, given population ageing and increasing demand for it. Transformation of acute care hospital beds into long–term care beds or increase availability of community–based services are the options. Such a transformation of Czech inpatient care, together with an increase in short–term interventions/hospitalizations, would help decrease the share of funding devoted to inpatient care, because long–term care is significantly cheaper than acute care[11].

Efficiency analysis of Czech acute care hospitals in Section 4 acknowledged the **importance of the DRG reimbursement system.** When the DRG case–mix index was included into the analysis - together with a variable accounting for publication outputs of hospitals - variation across efficiency scores decreased significantly. On average, only less than 5 % of inefficiency of Czech general hospitals remains to be explained in further research. Some portion of variations of efficiency was justified by the presence of a specialized center in a hospital, while other determinants of inefficiency pointed out to specific problems worth targeting. It was shown that **big and teaching hospitals should be financed according to a different scheme than small and medium ones.**

The development of the DRG reimbursement system in the Czech Republic is highly appreciated not only for benchmarking purposes as used in Section 4, but primarily for its potential to increase efficiency of the healthcare system per se. Section 4 found out that the **alternative to the case–mix approach is a system** which **looks at local demographics, size, mission and legal form of hospitals, but with higher administrative costs**. Still there is much to improve to be able to reap the full potential of the **DRG reimbursement system** as discussed in Section 5. **Major problems** of the system are currently in the following:

- individual payment rates
- small sample of reference hospitals to set the optimal cost of cases
- insufficient homogeneity within DRG groups
- upcoding

[11] Munton *et al.* (2011) argue that well–structured community based services are even cheaper than hospital care.

The new initiatives which have just been set should primarily **concentrate on (i) gradual convergence of individual base payment rates to a flat rate, (ii) homogenizing DRG groups, (iii) increasing the number of reference hospitals from which they obtain cost data to set optimal relative weights; and (iv.) design a system of penalties which would discourage managers from upcoding, unbundling and coding fraud.**

Czech hospitals report a considerably high rate of amortization which increases overtime. Capital investment has suffered from corruption, however with the Equipment commission recently established and the improving case–mix system, corruption should disappear. Capital costs are included in the Czech DRG relative weights, however publicly owned hospitals also receive investment subsidies, and thus receive reimbursement for capital costs twice. Either abolition of investment subsidies once DRG system functions optimally, or the introduction of two independent sets of weights for publicly–owned (both budgetary and corporatized hospitals) and private hospitals would increase efficiency of the system.

Section 7 identified an optimistic trend in short–term interventions/hospitalizations. However, provision of day care interventions in the Czech Republic is not a very wide–spread phenomena yet, which is reflected both by the fact that, at the time of writing, only data for day care interventions for 2012 was available, and in the low number of day care interventions reported. It is recommended that **day care interventions should be given preference to inpatient care** where possible.

The need for follow–up care, substitution effect between DRGs and daycare diagnoses and coding fraud seem to explain preference for hospitalizations to day care interventions but an econometric analysis is yet to be done.

While analyzing the Czech inpatient healthcare sector, one acknowledges the recommendation of OECD (2014) that the Czech healthcare data infrastructure should be improved in general. Institutions gathering the data and those analysing it should collaborate in order to produce reports that can can be used by professionals or policy-makers.

Recommendations:

1. Increase available possibilities of long–term care (long–term care hospital beds, community–based services, etc.)
2. Finance big and teaching hospitals according to a different scheme than small and medium hospitals
3. Improve the DRG reimbursement system as soon a possible to increase efficiency of the system. Specifically:
   - gradually converge individual base payment rates to a flat rate and use risk–corridors in utmost reasonable cases
   - homogenize DRG groups,
   - increase the number of reference hospitals which report cost data to set optimal relative weights,
   - design a system of penalties which would discourage managers from upcoding, unbundling and coding fraud.
4. Prioritize day care interventions to inpatient care where possible
5. Concentrate on a thorough collection of health data and make public institution possessing the data closely cooperate with academia, which will provide sophisticated data analyses.

9 Executive summary in English

Czech inpatient care facilities absorb a considerably high share of healthcare resources. Compared to other EU countries, the number of per capita hospital admissions is very high too WHO (2003–2012). Capital equipment in Czech hospitals is aging and is underutilized. Also other healthcare indicators, such as the reported length of stay for inpatient interventions and the low share of day cases raise concerns about cost–effectiveness in the Czech healthcare sector.

However, immediate conclusions from the first hand observation are often too hasty. Having introduced efficiency of the healthcare sector in the international context, this paper reviews findings of Votapkova & Stastna (2013) and Votapkova & Stastna (2013), which represent the most thorough analysis of Czech general hospitals. Votapkova & Stastna (2013) assess 99 general hospitals parametrically and Stastna & Votapkova (2014) assess 81 units non–parametrically with an overlap of 78 hospitals.

The paper sheds light on inefficiency determinants and points to specific areas which need to be targeted to increase efficiency of Czech hospitals. Section 6 links efficiency of Czech hospitals to their capital needs. Day care interventions are discussed in section 7 and their potential for the future is outlined. The progress of the DRG introduction flows through all the sections of the paper.

There are cross–country comparative efficiency analyses, such as Evans *et al.* (2001), Afonso & Aubyn (2004), or Raty & Luoma (2005),OECD (2002), Hakkinen & Jourmard (2007), Jourmard *et al.* (2008), Jourmard *et al.* (2010) or Varabyova & Schreyögg (2013). However, quantitative efficiency studies more frequently concentrate on a particular sub–sector of the healthcare system (hospitals, nursing homes, emergency departments, etc). Such sub–samples are more homogeneous and the results are more accurate. Of the sub–sectors, more than 50 % of studies analyze general hospitals.

Efficiency benchmarks aim to determine the maximum feasible set of outputs which can be produced from a given set of inputs in a particular setting. Depending on the type of efficiency (technical/allocative/cost), method of measurement (stochastic/deterministic) and a particular model at stake, **inputs** may be defined in (i) physical units as labor (physicians, nurses, non-medical staff) and capital (number of beds, equipment, etc), or (ii) in monetary terms as total costs which aggregates all inputs into one variable. Sometimes relative costs of inputs, i.e the combination of staff, beds, equipment, etc., are also important to achieve the desired level of output.

Ideally, health **output** should be measured as an increment to patient health status, or as averted deterioration of health because patients do not demand health services per se (Jacobs *et al.*, 2006). However, this is technically challenging to measure and hospital output has to be approximated by the number of admission or the number of patient days adjusted for the severity of cases and quality variables (e.g. mortality rates, technological index, doctor/bed, nurse/bed ratia). **Inefficiency determinants** describe the environment in which units operate and help identify sources of inefficiency.

Inputs to both Votapkova & Stastna (2013) and Stastna & Votapkova (2014) represent total operating costs, excluding capital costs and outpatient costs of hospitals. The vector of

variables used as hospital output is different in the two studies. Votapkova & Stastna (2013) used inpatient days disaggregated into acute and nursing care and did not account for the DRG case-mix index to capture severity of acute care cases which was being developed at the time when the analysis was carried out. Stastna & Votapkova (2014) adjusts acute care admissions for the hospital DRG–case–mix index which takes into account severity of cases treated in each hospital. In addition, Stastna & Votapkova (2014) includes a variable representing publications among outputs to account for the fact that big and teaching hospitals devote some of their productive time to research and teaching rather than just treatment. Both studies explain reasons for inefficiency or point at areas which should be targeted for efficiency to increase. However, the set of determinants differs between the studies. The adjusted vector of outputs in the latter cancelled the effect of some of the environmental variables previously used.

Average efficiency in Votapkova & Stastna (2013) reached 0.411 and 0.86 without and with determinants, respectively. If a hospital is either larger, not–for–profit, it is situated in a municipality with a larger share of the elderly or has a teaching status, it tends to be less efficient. Hospitals situated in bigger municipalities and in regions where also other general hospitals operate, are more efficient. The results of **Stastna & Votapkova (2014)** discovered average **efficiency** to be **0.903 and 0.951 for the unconditional and a conditional models, respectively.** The adjustment for the DRG case–mix index and incorporation of publications among outputs not only increased average efficiency scores remarkably, but also turned most of the environmental variables used in Votapkova & Stastna (2013) unimportant. **An alternative to the DRG mechanism would thus look at local demographics, size, mission and legal form of the institution but at significantly higher costs than the DRG system.**

The effect of the not–for–profit ownership status in Stastna & Votapkova (2014) turned favorable to performance, however significant at one tail only, i.e. the effect is not very profound. The effect is caused by **big/teaching hospitals which are usually not–for–profit** and are involved in research, thus **report a higher publication output**, and also **treat more complicated cases**, i.e. report higher main output as well, (which open them research questions or enable them to apply results of the research). A similar explanation is likely to hold for a significant and favorable effect of the presence of a specialized center in a hospital - hospitals with specialized centers report higher publication outputs and, they may also treat more complicated cases - thus tend to be more efficient than other hospitals.

Despite the strong and significant effect of **size** as a determinant of inefficiency in Votapkova & Stastna (2013), when efficiency scores were divided into groups according to the number of patients treated in the hospitals, the scores decreased with size and became more homogeneous within groups, both for the baseline model and the model with determinants. The group of big hospitals reported the lowest within group variation in the baseline model (0.077) but the largest variation in the model with determinants (0.121). Even though variable size was not significant in Stastna & Votapkova (2014), average efficiency scores increase as size group increases and scores became again more homogeneous within groups, both for conditional and unconditional models. The group of big hospitals was most homogeneous and the

group of small hospitals was most heterogeneous, both for the conditional and unconditional model.

Not accounting for the DRG–case– mix index and publication outputs would be a mistake that results in big and teaching hospitals being more inefficient than they actually are, relative to small and medium hospitals. Big and teaching hospitals often treat complicated cases and besides treatment, devote a portion of their productive time to research. Also other hospitals (small and medium ones) that do research and publish their findings differentiate from those that just treat, which is supported by the large standard deviation of efficiency scores among the group of small hospitals. **The results suggest that big and teaching hospitals should be funded separately from other hospitals.**

The **DRG system** in the Czech Republic is still a **relatively new** phenomenon, thus there is still much to improve. It was first implemented in **2007**. **In 2013**, as much as **85 % of acute–care hospital reimbursement was done through the DRG**. The current version of the Czech IR-DRG grouping system contains **366 base groups** and most of them are divided into three severity levels - major complications and comorbidities (MCC), complications and comorbidities (CC) and without MCC/CC, thus there is a **total of 1,046 groups in 2014. In 2014 the base payment rate**, that after multiplying by the relative weights determine the level of reimbursement, **was the same for all hospital.** However, so called **"risk corridors"** were established which ensure that reimbursement of the hospital cannot drop below a threshold level.

Only acute care is reimbursed through the DRG. **All procedures performed, drugs, blood and medical devices used, external laboratory tests outsourced, capital, operating and overhead costs expended - all are covered in the cost of the case to calculate DRG relative weights.** Teaching, research and development costs are excluded and are financed through public funds, instead.

Once the Czech DRG system effectively functions, hospitals will be more efficient, hospital benchmarking will simplify and administrative costs of hospital financing decrease. Major drawbacks of the current set–up of the DRG system are:

- A large number of individual base payment rates and too narrow risk corridors.

Having given time to hospitals to adapt, individual payment rates should gradually converge to a flat rate with risk corridors used only in utmost reasonable cases.

- Small sample of reference hospitals to set the optimal cost of cases
- Insufficient clinical and economic homogeneity within DRG groups
- Upcoding, unbundling and coding fraud

Capital purchases of Czech hospitals have long suffered from corruption. The establishment of the Equipment Commission in 2014 and a well–functioning DRG reimbursement system after DRG–restart, should eradicate corruption.

Whether countries include capital costs into the DRG depends on the objective of the particular healthcare system. When capital costs are not included in the

case–mix system, there may arise a number of potential risks - care volumes inflation, up-coding or shifting technological interventions out of inpatient episodes. They are not topical, however, when hospitals are reimbursed for capital costs otherwise. Once the DRG payment system functions optimally and hospitals are reimbursed for capital costs either within the DRG or otherwise, none of these risks should be a problem. Rather, a problem of the Czech system is that **state, regional, municipal and city (both budgetary and corporatized) hospitals receive investment subsidies, besides DRG payments.** They are thus reimbursed twice for capital costs. Once the DRG system works well, **investment subsidies** for public hospitals should be **abolished**, or alternatively, a **system of two sets of relative weights separate for public and private hospitals** would make the system more efficient.

Daycare is a specific category of healthcare services in the Czech Republic, being uniquely collected only since 2012. It denotes **hospitalization for less than 24 hours during which a planned surgery is carried out.** Prior to 2012, only hospitalizations shorter than 24 hours were recorded, which included both day care interventions and hospitalizations originally planned for longer than 24 hours, that were shortened due to various reasons. **Daycare is** not **reimbursed** through the DRG, as opposed to e.g. Finland, France, Ireland, the Netherlands or Sweden, but **through the fee–for–service.** Even though only data for day cases for 2012 is available, the number of day cases is expected to follow the increasing trend of short–term hospitalizations. Compared to EU countries, the Czech Republic reports significantly lower numbers of day cases per 100.000 inhabitants (both in total and diagnosis–wise), even though **EUROSTAT definition** probably **differs from the Czech official definition of daycare.**

Most frequently, day-case surgeries are carried out on a **knee joint**. Diagnosis–wise descriptive statistics indicates that the **need of a follow–up care may explain preference for hospitalizations to day cases.** Nevertheless, **substitution** between inpatient diagnoses and daycare; and **coding fraud** are likely to explain a portion of the effect too. Given the improve statistical reporting of daycare since 2012, a sophisticated econometric analysis will reveal important policy implications in the years to come.

10 Executive summary in Czech

Velká část prostředků věnovaných na zdravotnictví je v České republice vynakládána na lůžkovou zdravotní péči. V porovnání s ostatními zeměmi Evropské unie vykazuje Česká republika značný počet hospitalizací na 100 000 obyvatel (WHO, 2003–2012). Kapitálové vybavení nemocnic zastarává a je nedostatečně využíváno. Rovněž i další proměnné, jako je délka hospitalizací či málo jednodenní péče, vzbuzují obavy, že je české zdravotnictví neefektivní.

Na první pohled jasné závěry jsou však příliš ukvapené. Tato studie podává nejprve přehled o efektivitě zdravotní péče v mezinárodním kontextu, poté představuje výsledky dvou studií, Votapkova & Stastna (2013) a Stastna & Votapkova (2014), které jsou v současné době nejdůkladnější analýzou efektivity lůžkové zdravotní péče v českém prostředí. Votapkova & Stastna (2013) analyzuje efektivitu 99 nemocnic parametricky a Stastna & Votapkova (2014) hodnotí 81 nemocnic neparametrickou obálkou metodou - 78 nemocnic je použito shodně v obou studiích.

Předkládaná studie porovnává výsledky obou statí zabývajících se efektivitou českých nemocnic. Analyzuje nejen dosažené výsledky relativní efektivity, nýbrž i determinanty neefektivity, jež poukazují na specifické oblasti, které je potřeba cílovat, aby se fungování českých nemocnic zefektivnilo. Studie dále propojuje efektivitu českých nemocnic s jejich kapitálovými potřebami, diskutuje zavádění DRG a jednodenní péče a poukazuje na jejich potenciál do budoucna.

V literatuře najdeme studie, které porovnávají relativní efektivitu zdravotních systémů různých zemí, například Evans *et al.* (2001), Afonso & Aubyn (2004), Raty & Luoma (2005), OECD (2002), Hakkinen & Jourmard (2007), Jourmard *et al.* (2008), Jourmard *et al.* (2010) nebo Varabyova & Schreyögg (2013). Studie analyzující efektivitu vybraných částí zdravotních systému (nemocnice, LDN, pohotovost, atd.) v rámci jedné země jsou však mnohem častější, jelikož analyzovaný vzorek je homogennější a výsledky přesnější. Více než 50 % studií analyzuje všeobecné nemocnice.

V rámci měření efektivity hledáme maximální možnou kombinaci výstupů, které může být v daném kontextu dosaženo s použitím určitého souboru vstupů. V závislosti na typu efektivity (technická/alokační/nákladová), metodě měření (stochastická/deterministická) a vybraného modelu, používáme **vstupy** ve (i) fyzických jednotkách jako je práce (počet lékařů, sester, ostatního personálu), kapitál (počet lůžek, vybavení, atd.); nebo (ii) v peněžním vyjádření, tj. celkové náklady, které agregují všechny vstupy do jedné proměnné. Někdy hraje roli i poměr relativních cen vstupů, t.j. kombinace personálu, počtu lůžek, vybavení.

Výstupem při měření efektivity zdravotní péče by v ideálním případě mělo být zlepšení zdravotního stavu pacientů, případně odvrácené zhoršení jich zdravotního stavu, jelikož zdravotní péče není poptávána pro svou podstatu jako většina ostatních statků a služeb (Jacobs *et al.*, 2006). Zjistit takovouto proměnnou je však technicky nemožné, proto studie zabývající se efektivitou zdravotní péče aproximují výstup počtem hospitalizací nebo počtem ošetřovacích dní, jež je potřeba ošetřit o náročnost případů a kvalitu (např. míra úmrtnosti, technologický index, počet lékařů a sester na lůžko). **Determinanty neefektivity** popisují prostředí v nichž nemocnice fungují a pomáhají identifikovat zdroje neefektivity.

Vstupem obou studií, Votapkova & Stastna (2013) a Stastna & Votapkova (2014), jsou celkové provozní náklady nemocnice, které však nezahrnují kapitálové náklady a náklady na ambulantní péči. Proměnné použité jako výstupy se však liší. Votapkova & Stastna (2013) používá počet ošetřovacích dní rozdělený na akutní a následnou péči a nezohledňuje DRG case–mix index, jelikož v době analýzy ještě nebyl zcela funkční. Stastna & Votapkova (2014) náročnost případů již zohledňuje, kdy počet hospitalizací váží pomocí DRG case–mix indexu. Stastna & Votapkova (2014) dále zahrnuje publikační výstupy nemocnic, čímž zohledňuje, že velké a fakultní nemocnice věnují kromě léčení část produktivního času výzkumu. Obě studie vysvětlují důvody neefektivity, případně poukazují na oblasti, které je potřeba cílovat. Vektor proměnných použitých jako determinanty se v jednotlivých studiích liší. Upravený vektor výstupů použitý v druhé studii totiž pojmul efekty některých environmentálních proměnných použitých v první studii.

Votapkova & Stastna (2013) zjistila průměrnou efektivitu 0.411 bez determinantů a 0.86, když byly determinanty zahrnuty. V případě, že je nemocnice velká, příspěvková, má status fakultní nemocnice nebo se nachází v obci s velkým podílem osob nad 65 let, je méně efektivní. Nemocnice, které se nacházejí ve větších městech a v kraji, kde funguje více nemocnic, jsou efektivnější. **Efektivita bez zahrnutí determinantů ve studii Stastna & Votapkova (2014) vzrostla na 0.903. Když byly determinanty zahrnuty, vzrostla dále na 0.951.** Zahrnutí DRG case–mix indexu do analýzy efektivity nejen značně zvýšilo průměrnou efektivitu, ale rovněž i zrušilo efekt mnohých determinantů použitých v první studii. **Alternativou k DRG by tedy mohl být mechanismus, který bere v úvahu demografické charakteristiky místa, kde se nemocnice nachází, velikost, právní formu a status. Systém DRG je však výrazně levnější.**

Skutečnost, že je nemocnice příspěvkovou organizací, má pozitivní, avšak ne příliš robustní, vliv na efektivitu (Stastna & Votapkova, 2014). Tento efekt mají na svědomí **velké a fakultní nemocnice,** které jsou obvykle neziskové a provádějí výzkum - tudíž **vykazují vyšší publikační výstup a léčí komplikovanější případy**, čímž vykazují též vyšší hlavní výstup. Léčení komplikovaných případů jim často nabízí nové výzkumné otázky nebo jim umožňuje aplikovat výsledky svého výzkumu. Stejné vysvětlení můžeme použít i pro pozitivně signifikantní vliv přítomnosti specializovaného centra v nemocnici. Nemocnice, které disponují specializovaným centrem, vykazují vyšší publikační výstupy a také často léčí komplikovanější případy.

Ve studii Votapkova & Stastna (2013) měla velikost negativně signifikantní vliv na efektivitu. Když byly však výsledné hodnoty relativní efektivity rozděleny do skupin podle velikosti nemocnice (tj. podle počtu léčených pacientů), byla nižší efektivita i přesto zaznamenána ve větších nemocnicích. Zároveň vzrostla homogenita výsledků v rámci velikostních skupin jak v modelu bez determinantů, tak v modelu s determinanty. Skupina velkých nemocnic vykázala nejvyšší homogenitu v modelu bez determinantů (0.077), avšak nejvyšší heterogenitu v modelu s determinanty (0.121). I když Stastna & Votapkova (2014) nezjistila signifikantní vliv velikosti jako determinantu neefektivity, při rozdělení do velikostních skupin vidíme, že efektivita roste s velikostí nemocnice. Výsledky se staly opět více homogenní, jak v modelu s determinanty tak bez nich. Tentokrát byla v případě obou modelů nejvíce homogenní skupina

velkých nemocnic a nejvíce heterogenní byly malé nemocnice.

V případě, že bychom do modelu neefektivity nezahrnuli DRG case–mix index a publikační výstupy, byly by velké a fakultní nemocnice více neefektivní, než ve skutečnosti jsou v porovnání s menšími nemocnicemi. Důvodem je, že velké a fakultní nemocnice se vedle léčby věnují i výzkumu a léči komplikovanější případy. Rovnější i menší nemocnice, které se věnují výzkumu se odlišují od těch, které pouze léčí, což dokazuje velká heterogenita výsledků ve skupině malých nemocnic. Výzkum v malých nemocnicích však není příliš obvyklý. **Velké a fakutlní nemocnice by proto měly být financovány odlišným schématem než ostatní nemocnice.**

DRG systém je v České republice relativně **nový** a stále je na něm co zlepšovat. Systém DRG byl **poprvé uveden do praxe v roce 2007, avšak v roce 2013 jím již bylo hrazeno 85 % akutní péče.** Současný systém IR–DRG sestává z 366 bází, z nichž většina je rozdělena do tří podskupin dle náročnosti - hlavní komplikace a komorbidita (MCC), komplikace a komorbidita (CC) a skupina bez MCC/CC. V roce 2014 tedy ČR měla **1 046 skupin**. **Základní sazba**, která po pronásobení relativní vahou určuje výši úhrady, **je stejná pro všechny nemocnice**. Vedle základní sazby však existují "risk koridory", která zaručují minimální úhradu všem nemocnicím.

Metodou DRG je hrazena pouze akutní péče. Do **výpočtu relativních vah jsou zahrnuty náklady za veškeré úkony, léky, krev, použité zdravotnické prostředky, laboratorní testy, kapitálové, provozní a režijní náklady.** Do výpočtu nevstupují náklady na výuku, vědu a výzkum, které jsou hrazeny z jiných zdrojů (např. dotací).

Až bude DRG systém správně a optimálně fungovat, budou nemocnice efektivnější, zjednoduší se porovnávání nemocnic z hlediska efektivity a klesnou administrativní náklady na správné financování nemocnic. Hlavními problémy současného nastavení DRG systému v České republice jsou:

- Mnoho individuálních základních sazeb a příliš úzké risk koridory. Až se nemocnice adaptují na systém úhrad přes DRG, mělo by docházet ke konvergenci individuálních základních sazeb k jednotné základní sazbě a "risk koridory" by měly být používány minimálně.
- Malý vzorek referenčních nemocnic používaný ke stanovení optimálních nákladů případu
- Nedostatečná klinická a ekonomická homogenita v rámci DRG skupin
- Upcoding, unbundling a jiné podvody při kódování případů

Kapitálové nákupy nemocnic jsou v českém kontextu dlouhodobě zatíženy korupcí. Vznik Přístrojové komise v roce 2014 a dobře fungující systém úhrad pomocí DRG by měly do budoucna pomoci korupci vymítit.

Jednotlivé země zahrnují kapitálové náklady do DRG či nikoliv podle toho, jaký cíl daný zdravotní systém sleduje. Pokud nejsou kapitálové náklady v DRG zahrnuty, musí existovat jiný způsob, jak nemocnicím kapitálové náklady kompenzovat, jinak hrozí upcoding, nesprávné vykazování objemu péče či přesun zákroků náročných na kapitál

mimo lůžkovou péči. Pokud však systém DRG funguje a kapitálové náklady jsou nemocnicím propláceny buď přes DRG nebo jinou formou, žádné z těchto rizik by nemělo hrozit. Problémem v českém prostředí však je **dvojí proplácení kapitálových nákladů nemocnicím, jejichž vlastníkem je stát, kraj či jiný územně správní celek.** Jedná se jak o příspěvkové, tak korporatizované nemocnice, kterým jsou kapitálové náklady hrazeny přes DRG, a zároveň získávají investiční dotace od vlastníka. Až bude DRG systém optimálně fungovat, tj. po DRG restart, **je vhodné buď investiční dotace nemocnicím ve veřejném vlastnictví zrušit, nebo zavést systém dvojích relativních vah zvlášť pro veřejné a soukromé nemocnice.**

Jednodenní péče tvoří v České republice samostatnou skupinu zdravotních služeb, samostatně je však statisticky vykazována UZISu až od roku 2012. Jednodenní péčí se rozumí **hospitalizace kratší než 24 hodin, v rámci níž došlo k plánovanému zákroku.** Před rokem 2012 byly statisticky vykazovány pouze hospitalizace kratší než 24 hodin, které však zahrnovaly jak jednodenní péči, tak hospitalizace, které měly původně trvat více než 24 hodin, a byly z nějakého důvodu zkráceny. **Jednodenní péče není hrazena v ČR přes DRG,** na rozdíl od např. Finska, Francie, Irska, Nizozemí nebo Švédska, **nýbrž výkonově.** Ačkoliv jsou statistická data jednodenní péče dostupná pouze pro rok 2012, předpokládáme, že bude objem jednodenní péče do budoucna růst, vzhledem ke zvyšujícímu se počtu krátkodobých hospitalizací obecně. V porovnání s ostatními evropskými zeměmi vykazuje Česká republika výrazně méně případů jednodenní péče na 100 000 obyvatel (v součtu i v rámci jednotlivých diagnóz). Je však nutno mít na paměti, že **definice jednodenní péče používaná Eurostatem se pravděpodobně liší od české oficiální definice.**

Operace kolenního kloubu je v České republice nejčastějším zákrokem jednodenní péče. Deskriptivní statistika jednotlivých diagnóz naznačuje, že **pacienti bývají hospitalizováni, pokud se předpokládá, že bude jejich stav vyžadovat následnou rehabilitaci.** Avšak **záměrně nesprávné kódování případů** pravděpodobně též vysvětluje část substitučního efektu. S ohledem na zdokonalující se systém statistického kódování případů jednodenní péče ekonometrická analýza do budoucna odhalí konkrétní důvody.

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Appendix

Table A1. Overview of world empirical literature

Study	Country	Note
	Pioneers	
Nunamaker (1983)	United States	
Sherman (1984)	United States	
	After 1990s	
Zuckerman *et al.* (1994)	United States	first to explain inefficiency
Vitaliano & Toren (1996)	United States	
Rosko & Chilingerian (1999)	United States	
Rosko (2001)	United States	
Wagstaff & Lopez (1996)	Spain	
Prior (1996)	Spain	
Magnussen (1996)	Norway	
Hofmarcher *et al.* (2002)	Austria	
Farsi & Filippini (2004)	Switzerland	
Jacobs (2001)	United Kingdom	
Blank & Valdmanis (2010)	Netherlands	
	Latest studies	
Ludwig *et al.* (2010)	Netherlands	analyzes principal–agent problem
(Barros *et al.*, 2013)	Portugal	
Besstremyannaya (2013)	Japan	
Chowdhury *et al.* (2014)	Ontario, Canada	
	Developing world	
Chang *et al.* (2004)	Taiwan	
Hu *et al.* (2012)	China	
Dutta *et al.* (2014)	India	
	Overview studies	
Worthington (2004)		
Hollingsworth (2008)		
Busse *et al.* (2012)		relation to ownership

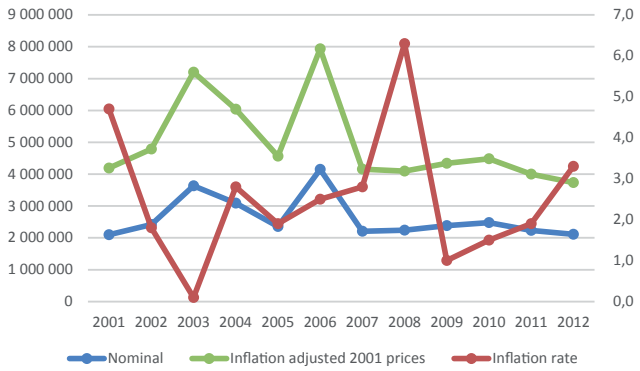
Note: Sorted by (1) year and (2) country.
Source: Author's compilation

Table A2. Variable description of Votapkova & Stastna (2013)

Inputs & outputs	
total inpatient costs	all inpatient excluding capital costs
acute days	sum of intenstive, surgery and non-surgery days
nursing days	long-term care days
doctor-bed ratio	number of doctors per available bed - quality indicator
nurse-bed ratio	number of nurses per available bed - quality indicator
Determinants	
size	hospitals divided into 3 groups acc. the number of patients treated: (1) small (below 10,000), (2) medium (10,000-20,000) and (3) big (above 20,000) 33 observations in each group
not-for-profit status	dummy 1 if public not–for–profit, 0 if either public for–profit (> 50 % public share)[a] or private for–profit
share of the elderly	share of 65+ in the municipality
teaching status	dummy 1 for a faculty hospital, 0 otherwise
population	number of total inhabitants in the municipality
competition	the number of general hospitals in the region

Note: [a] Starting in 2003, many regional hospitals were corporatized and became de facto a private legal entity. However, regional authorities retained more than 50 % of shares of these newly created joint–stock companies ("a.s.").

Figure A1. Operational subsidies from the founder, 2001–2012, thds. CZK



Source: Institute of Health Information Institute of Health Information and Statistics of the Czech Republic (2003-2013)

Table A3. Variable description of Stastna & Votapkova (2014)

Inputs & outputs	
total inpatient costs	all inpatient excluding capital costs
acute patients DRG-case mix index adjusted	inpatient admissions (excluding ambulatory care) adjusted for the DRG case–mix index
nursing patients	long–term care admissions
publications	first principle component of the Principle Component Analysis (PCA) of the data from the Web of Science database. Inputs to PCA are: (i) articles, (ii) meeting abstracts, (iii) letters, reviews, proceedings papers weighted by the share of authors affiliated to the hospital
Determinants	
specialization	dummy 1 if a specialized center situated in the hospital list of specialized centers from the Ministry of Health
not-for-profit status	dummy 1 if public not–for–profit[a] 0 if either public for–profit (> 50 % public share) or private for–profit
year 2009	dummy 1 if observed in 2009, 0 otherwise
year 2010	dummy 1 if observed in 2010, 0 otherwise
salary	average monthly salary in the district proxy for the price of labor and general price level

Note: [a] Starting in 2003, many regional hospitals were corporatized and became de facto a private legal entity. However, regional authorities retained more than 50 % of shares of these newly created joint–stock companies ("a.s.").

Table A4. Day cases per 100 000 inhabitants, selected diagnoses, 2010

	Czech Republic	Visegrad average	EU-28 average	EU-15 average	EU-13 average
Certain infectious and parasitic diseases (A00-B99)	5,7	15,8	76,0	60,3	94,7
Intestinal infectious diseases except diarrhoea	0,3	1,2	7,0	4,9	9,8
Diarrhoea and gastroenteritis of presumed infectious origin	0,5	2,6	17,7	7,7	31,0
In situ neoplasms	0,2	0,6	13,2	20,9	2,9
Benign neoplasm of colon, rectum, anus and anal canal	0,5	8,1	37,0	61,3	4,7
Leiomyoma of uterus	3,6	7,3	8,4	9,9	6,5
Other in situ neoplasms, benign neoplasms and neoplasms of uncertain or unknown behaviour (remainder of D00-D48)	6,0	54,0	160,4	197,6	110,8
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	1,5	21,5	86,2	120,7	44,8
Anaemias	0,4	6,5	55,9	79,3	24,6
Endocrine, nutritional and metabolic diseases (E00-E90)	3,6	36,7	110,9	149,2	64,9
Mental and behavioural disorders (F00-F99)	14,8	20,3	106,6	94,0	121,7
Diseases of the nervous system (G00-G99)	14,9	42,9	170,7	241,8	85,4
Diseases of the eye and adnexa	8,8	122,7	493,2	680,3	268,8
Diseases of the ear and mastoid process	5,6	15,0	63,6	100,8	18,9
Diseases of the circulatory system (I00-I99)	49,3	123,3	279,1	362,3	179,2
Diseases of the respiratory system (J00-J99)	27,8	54,8	195,5	213,7	173,7
Diseases of the digestive system (K00-K93)	26,8	88,0	514,4	799,2	172,6
Diseases of the skin and subcutaneous tissue (L00-L99)	2,3	24,1	166,2	223,6	97,5
Diseases of the musculoskeletal system and connective tissue (M00-M99)	18,8	61,6	408,2	642,2	127,5
Diseases of the genitourinary system (N00-N99)	90,0	348,8	642,2	442,1	882,4
Pregnancy, childbirth and the puerperium (O00-O99)	90,4	174,4	233,8	241,3	224,7
Certain conditions originating in the perinatal period (P00-P96)	0,6	3,3	8,0	11,2	4,1
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	4,1	16,7	46,6	61,3	29,0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	24,2	126,2	336,5	417,7	239,0
Injury, poisoning and certain other consequences of external causes (S00-T98)	26,4	297,3	239,5	262,7	211,7
Factors influencing health status and contact with health services (Z00-Z99)	31,4	138,4	1225,9	1911,4	403,4

Source: EUROSTAT, 2010

Note: without Greece, Bulgaria, Slovakia, Belgium, Denmark, Latvia.

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