Charles University in Prague

Faculty of Social Sciences
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BACHELOR THESIS

Estimating the Extent of Inefficiencies in the Czech Health Care System

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Declaration of Authorship

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Abstract

In this thesis, we tried to find possible methods of estimation the extent of inefficiencies in healthcare and apply them on Czech data. We reviewed recent literature on this subject and from the literature we selected 3 methods that were used in this thesis. We estimated that costs of error and fraud concerning payments and provision of care in 2010 is roughly between 9,5 to 25,8 billion CZK, extra treatment for people abusing prescription opioids cost approximately 247,8 million CZK in 2011 and that costs of unnecessary use of C-Section in 2011 amounted to 184,4 million CZK. We also broke down the 2010 Czech healthcare expenditures and compared indicators across countries to uncover other possible problems.

JEL Classification	F12, F21, F23, H25, H71, H87
Keywords	Healthcare inefficiency, literature review, estimation, opioid abuse, C-Section, audit
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Abstrakt

V této práci jsme se pokoušeli najít možné metody odhadování rozsahu neefektivit ve zdravotnictví a aplikovat je na česká data. Na toto téma jsme přezkoumali aktuální literaturu a vybrali z ní 3 metody, které jsme použili k odhadům v této práci. Odhadli jsme, že chyby a podvody vzhledem k placení a poskytování péče v roce 2010 stály zhruba 9,5 až 25,8 miliard Kč, že extra péče pro lidi zneužívající opiátové léky na předpis stály v roce 2011 přibližně 247,8 milionů Kč a že extra náklady na zbytné porody císařským řezem se v roce 2011 vyšplhaly na 184,4 milionů Kč. Také jsme rozebrali náklady na České zdravotnictví z roku 2010 a srovnali ukazatele se zahraničím, abychom odhalily další možné problémy.

Klasifikace	F12, F21, F23, H25, H71, H87
Klíčová slova	Neefektivita ve zdravotnictví, literature review, odhad, zneužívání opioidů, cisařský řez, audit
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Acronyms

CS – Caesarean Section, C-Section

ČSU - Czech Statistical Office

GDP – Gross domestic product

MRI – Magnetic resonance imaging

MZČR - The Ministry of Health of the Czech Republic

NZIS - National Health Information System

OECD - Organisation for Economic Co-operation and Development

PETS - Public Expenditures Tracking Surveys

ÚZIS - Institute of Health Information and Statistics of the Czech Republic

US HHS - US Department of Health and Services

VAT – Value addend tax

WHO – World Health Organisation

Bachelor Thesis Proposal

Healthcare is one of the biggest sectors of world's economy and the trend of increasing healthcare spending raises many questions. Healthcare systems are very complex and due to its structure it is prone to inefficiencies and corruption (Vian 2008; Holčík 2004). An important question is how big the extent of these inefficiencies is.

 In this thesis, I would like to create a literature review on estimation of the extent of inefficiencies in healthcare structured according to methods and areas of inefficiencies, find methods suitable for Czech Republic and apply them on Czech data. The result should be a rough estimate of Czech healthcare inefficiencies and a summary of methods for further study of Czech healthcare.

Outline:

1. Introduction
2. Literature review
3. Data on healthcare in Czech Republic
4. Estimates of inefficiencies
5. Conclusions

1   Introduction

Health care is a massive and complex sector of world economy. According to latest WHO global health expenditure fact sheet total spending on health care is 6.5 trillion USD and on a rising trend. The increasing volume of spending on health care raises many questions and creates budgetary pressures especially for countries with publicly provided healthcare.

The question I want to discuss in this thesis is if we are getting our money's worth. Is the money we pay actually spent on our health? This question is not easy to answer as medical science is getting technologically more and more complex and therefore also more expensive, the output of health care system is not easily measurable and it is difficult to distinguish resources wastage from normal operational costs and standard treatment from over-, under- and mistreatment.

Most of the literature agrees that health care provision is prone to corruption and inefficiency. It might be caused by the high number of agents and information asymmetry between them (Vian 2008). Health care systems obviously vary, but there are usually five key actors in health care and their interaction is best summarized in figure 1, where we can see many opportunities of corruption and waste or abuse of resources. Existence of such inefficiencies is often proved by anecdotal evidence, however measuring the extent of how much is lost through different flows is not easily determined.

Czech healthcare system is since the Velvet Revolution rather unstable. It is financed mostly by public health insurance, which in 2010 amounted to 76.6% of total healthcare expenditures (Kinkorová and Topolčan 2012). Most care is covered by the insurance, but there are also procedures that the patient has to co-finance. Patients also have to pay regulation fees per service provided and per night in hospital, which were introduced in 2008.

One of the problems might be that there is no long term concept of healthcare whether it is in allocation process (Háva 2012) or in terms of predictive, preventive and personalised medicine (PPM) (Kinkorová and Topolčan 2012). The analysis of Czech healthcare can therefore be beneficial to better understands the downfalls of the system and create a long term concept to improve efficiency of Czech healthcare.

In section 2 we will review recent literature on topic of estimating the extent of inefficiency in healthcare. In section 3 we will describe data we are going to use for estimation of inefficiencies, break down health care expenditures of Czech Republic and compare main indicators across OECD countries. In section 4 we will identify applicable methods of estimation the extent of inefficiencies and apply them on our data. We will conclude our findings in section 5.

Figure 1: Diagram of actors in healthcare
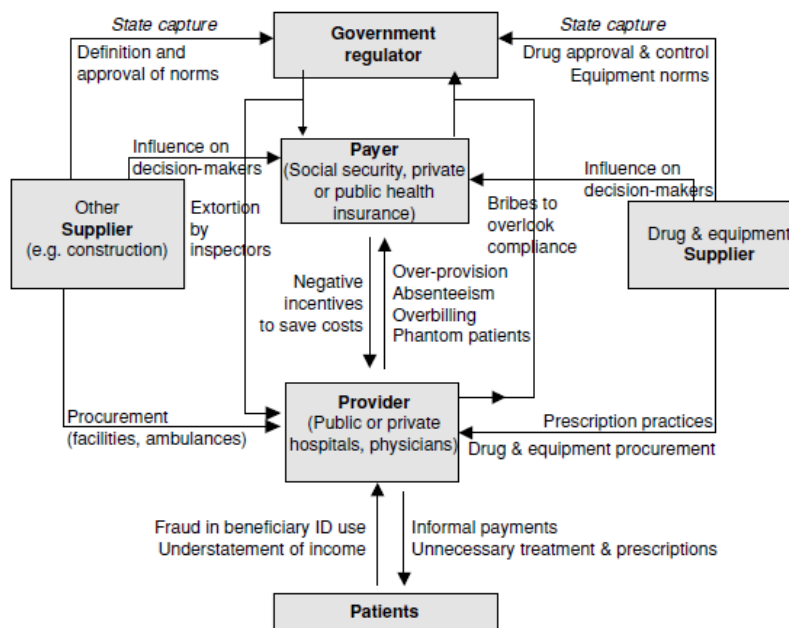
Source: Transparency International, Global Coruuption Report 2006

2 Literature Review

In this section we will try to summarize academic literature dealing with inefficiency in healthcare and show different methods of empirical studies trying to estimate extent of inefficiencies in health care sector and compare applicability to Czech Republic.

We will summarize papers studying efficiency in 7 categories according to their methodology in following order:

1 Audits
2 Surveys
3 Price differences
4 Single procedure study
5 Input-output models
6 Drug prescription analysis
7 Case studies

I will now discuss these categories one by one:

2.1 Audits

The most precise way to estimate how much is lost in hospitals or on other levels of financial flows is by auditing. Most of the literature dealing with overpayment or overtreatment is often referencing US Department of Health and Services (US HHS) which is trying to uncover extent of improper payments connected to their federal insurance programs like Medicare and Medicaid. This is being done by collecting a sample of insurance claims and checking them with respective medical documentation to uncover errors or frauds, namely overpricing, ghost patients, up-coding (billing for more expensive procedure than actually used), unnecessary treatments and other suspicious features. These audits are often accompanied by checking with the actual beneficiary to check if the billed procedure was actually provided, however this is often seen as unreliable source of data, because anecdotal evidence shown that beneficiaries often do not remember physicians name or procedures they received.

The rules that are applied for claims checking are often discussed, there are studies arguing that they are underestimating the actual amount of improper payments and others argue that the results are overestimated.

The result of these Medicare and Medicaid studies has been that improper payments amount to around 5-10% of overall costs ("High-Error Programs | Payment Accuracy" 2013).

Similar studies have also been conducted in individual states with all claims, not just for federal programs. The Medi-Cal Payment Error Study for example found rate of improper payments to be 3,57% of all payments (DHCS 2013).

(Brooks, Button, and Gee 2012) summarized 69 results from 6 countries to create more global evaluation of how much is lost through error and fraud. This resulted in a range of 3,29% - 10% of total expenditures lost to error and fraud.

In developing countries, where healthcare is mostly organized by state, World Bank is conducting Public Expenditures Tracking Surveys (PETS) by which they are trying to determine how much money assigned by the government actually gets to hospitals. The method has many downfalls and does not seem to be cost effective way to measure leakages (Lindelow 2006). It uses audits on all the channels the many flows through. However probably the most valuable data they obtain is usually the staff and patients surveys, which cannot measure how much is missing, but often show possible problems of the system.

These studies however are difficult to conduct, due to big sample size and problems connected with access to medical records and insurance claims by individuals or independent researchers. The upside is that this method is applicable everywhere and can also uncover suspicious contracts between other actors, not just provider-beneficiary. However for a small budget research this is probably a not feasible method. However studies with different methodologies do not have enough solid data to determine how much are the resources actually wasted in terms of money.

2.2 Surveys

This type of approach seems to be preferred by many empirical studies. Data are collected by surveying mainly patients, doctors, nurses and sometimes other actors to measure perception of corruption, misuse and abuse of resources in hospitals or health care system in general. The obvious pitfall of this approach is that we are dealing with soft data, meaning we are measuring perception of corruption not actual

levels of corruption and some anecdotal evidence showed, that the perception does not always reflect reality (Vian 2008). Also the wording of question in the survey and definition of the inefficiency we are looking for can often change results. However this type of data can still be useful to uncover problems in the health care system.

Figure 2: Example of results of surveys on corruption and fraud in healthcare

Table A.5 Share of Doctors and Nurses Who Perceive Corruption, by Type of Action (In percent)

Type of corruption	Doctors	Nurses
Evidence of physician absenteeism	79.5	97.8
Unauthorized charges to patients	85.4	90.1
Theft of equipment and supplies	71.2	82.9
Number of responses	113	328
No answer (%)	27.5	15.8

Source: Survey of personnel and patients.

Table 3.7 Measures of Theft in Public Hospitals

	Share stating that theft occurs (%)	Share of supplies stolen (%)
Surgical supplies	67.0	10.1
Medicines	64.4	13.4
Equipment	50.1	5.7
Food	42.3	12.2
Others	28.2	3.4

Source: Survey of hospital staff.

Source: Diagnosis Corruption: Fraud in Latin America's Public Hospitals, 2001

Source: Diagnosis corruption: Fraud in Latin America's Public Hospitals, 2001

Surveys are also used to collect measures of efficiency or intensity of healthcare. These surveys are usually compared across countries to evaluate performance of individual systems (Schoen et al. 2007).

This type of studies was done almost everywhere even in Czech Republic and other Central and East European countries. Central and East European countries are usually used to assess efficiency of different systems of payments or insurance, because of the various health care reforms in these countries after the fall of the Soviet Union (Wagstaff and Moreno-Serra 2009; Moreno-Serra and Wagstaff 2010). They are often accompanied with some observational data to find determinants of these

inefficiencies or to find a link between these inefficiencies and quality of health care or to find out if spending on regulation is cost-effective (Becker, Kessler, and McClellan 2005).

The usual results of these empirical studies (Figure 2) is showing how is corruption performed and to what extent, however it is unable to measure resources lost to corruption, improper use, or unnecessary treatment in terms of money or percentage of budget.

2.3 Price differences

This approach is often connected to survey studies. It compares price differences in hospital supplies in different hospitals across country. It can be measured as a constructed price index from weighted average of all concerned supplies or applied to just few key products separately. The actual prices used can be obtained from key informants in the hospital or from accounts. However there is a risk that the actually paid price is different from the invoiced price and the difference is used as a kickback. The price differences can of course be explained by several factors, like quantity bought (better prices for bulk purchases) or distance from the supplier. Then using dummy variables for hospitals and possible explanatory variables for price differences we can discover losses due to bad contracting or overpricing. Whether it is caused by corruption or just bad management is not clearly distinguishable.

These studies however do not usually try to measure how much could be saved, but try to find determinants of this type of inefficiency and how to avoid it.

2.4 Single procedure study

This is another method in which we can measure actual losses. However it is in very small scope. There are studies, some of them medical, some of them economic, which measure how certain high intensity costly procedure is overused or underused. It can be because of bad diagnosis, up-coding or self-referring. These types of studies are usually used on procedures which have well kept accessible data and clear rules of determining good and bad outcomes like heart disease treatment or child birth. (Psaty et al. 1999) showed by reviewing medical documentation and contacting the patients that up-coding of heart disease in the USA cost around $933 million extra in insurance reimbursement in 1993. (Currie and MacLeod 2013) estimated with the use of the Roy model that better diagnosis skills can lead to decreasing unnecessary c-sections by 11.7%. (Gibbons et al. 2010) estimated the worldwide costs of

unnecessary c-sections to be 2,32 billion USD. This includes estimated costs of Czech Republic which amounted to 2,7 million USD. (Hillman et al. 1990; Swedlow et al. 1992) used observational data to determine overuse of MRI screenings by self-referring physicians.

This method can show us how much can we save by better medication or procedure selection. (Psaty et al. 1999; Gibbons et al. 2010) even estimate the extent of overuse in monetary terms. However the scope of these estimates is rather small and we could probably find more works analyzing utilization of certain procedure.

2.5 Input Output models

These studies measure overall efficiency of health care. They collect macro data of spending on health care and compare them with some proxy of performance in health care (e.g. mortality in child births) etc. These data are then compared across countries (Garber and Skinner 2008) or across regions (Skinner, Fisher, and Wennberg 2005; Fisher et al. 2003). There are many ways in which we can compare different countries, example of measures can be seen in tables 1 and 2 on page Y. The difference can be explained by different production function or different demand for health care, but cannot tell us how much of the resources spent on healthcare are actually wasted. However it can show us a measure of effectiveness that is comparable across countries or regions.

Two studies however tried to estimate how much is actually wasted using patient and hospital data from Medicare for different regions in the USA (Skinner, Fisher, and Wennberg 2005; Fisher et al. 2003). Key in both studies was using an instrumental variable to explain Medicare spending (intensity of care) and see if increased spending has improved health quality or healthcare accessibility. (Fisher et al. 2003) used cohort study. It divided patient with several disease with well accessible data to five quintiles according to number of visits of patients in their last 6 months before death (instrumental variable, proxy for intensity of care) and then compared summary statistics in each quintile and found that difference in intensity and spending does not influence quality of care or the availability.

Figure 3: Comparable macro indicators reported by Garber and Skinner

Table 1: Utilization and Health Differences Across Selected OECD Countries

	U.S.	Canada	France	Germany	Nether-lands	U.K.	Japan
Per Capita Health Expenditures, 2005[a]	$6,347	3,460	3,306	3,251	3,192	2,580	2,474
Obesity Rate, 2005[b]	32	18	10	14	11	23	3
Adult Smoking, 2005[b]	17	17	23	24	31	24	26
% of Population > 65 with flu shot, 2004[c]	65%	62	68	48	73	71	43
Primary Care MD use of Electronic Records, 2005[d]	28%	23		42	98	89	
% Chronic ill skipping care because of costs, 2007[d]	42%	14		20	5	9	
Administration Costs, 2004[e]***	$465	131	238	172	132	57	52
Practicing MDs, 2006 (per 1000)[a]	2.4	2.1	3.4	3.8	2.5	2.1	2.0
Acute Hospital Beds (per 10,000), 2005[a]	2.7	2.8	3.7	6.4	3.1	2.3	8.2
Prescription Drugs, 2005 (grams per capita relative to US = 100)[f]	100	146	171	85		94	56
MRIs, 2006 (per 1 million)[a]	26.5	6.2	5.3	7.7	6.6*	5.6	40.1*
Wait > 6 months for elective surgery, 2007[d]	4%	14		3	2	15	
MD recommended treatment w/o benefit, 2007[d]	20%	12		20	13	10	
Reduction in "Avoidable" Deaths, 1997/98 to 2002/03 (per 100,000)[g]	5.1	12.0	10.8	16.0	15.0	27.2	
Generalist MD Annual Remuneration, 2004 (in $1,000)[e]	161	107	92	[77]**	117	118	

Notes: *2005 data. ** Specialist income; likely upper bound on generalist income. *** Expenditure on health administration and insurance by private insurers and central and local authorities. Sources: [a]OECD, 2008. Exchange rate determined using OECD measure of purchasing power parity; (PPP). [b]ACP, 2008; [c]Cylus and Anderson, 2007; [d]Schoen, et. al. (2007); [e]Peterson and Burton, 2007; [f]Danzon and Furukawa, 2008; [g]Nolte and McKee, 2008.

Source: Garber and Skinner, Efficiency, Is American Healthcare Uniquely Inefficient?, 2008

(Skinner, Fisher, and Wennberg 2005) went further and used linear and parametric two stage regression again using the same instrumental variable. They found no statistically or economically significant effect of spending on survival rate and therefore inferred that the 20% of Medicare dollars explained by the instrumental variable is wasted. This seems as an interesting method and might be feasible to conduct in Czech Republic as well, however it is possible that there is not big enough sample and health care intensity variation to find sensible results. The USA healthcare differs significantly across regions and the size of the sample is huge

compared to Czech Republic. However there already is some evidence, that spending in Czech hospitals differ, while quality and even quantity of care seems to be the same (Háva 2012).

We might also include studies dealing with administration costs. (Woolhandler, Campbell, and Himmelstein 2003) shows the estimation and difference between Canadian and American healthcare administration costs and their trends. Study tries to uncover possible reasons why administration costs differ, however there is no universal benchmark against which to compare to estimate losses due to administration inefficiency we can only compare those numbers across countries and find relative inefficiencies.

(Mathauer and Nicolle 2011) collected data and tried to explain the differences by various factors like health financing system. However they state that higher administration costs cannot simply be viewed as losses. Higher administration costs can lead to better outcomes so a study of administration costs alone cannot uncover inefficiencies.

2.6 Prescription drugs analysis

Bad drug prescription practice can cause not only resource leakages, but also health problems for the patient, future loss of efficiency of the treatment (resistance against antibiotics) and dependence or addiction to prescription drugs. Due to this fact many countries support programs to improve rational pharmacotherapy. These programs usually perform statistical analysis of drug prescriptions and check how they follow guidelines and overall trends. In Netherlands pharmacotherapy commissions called FTO, are meeting regularly with doctors, giving them statistics about their drug use and compare them with national guidelines and other doctors (Prokeš 2008). This seems as a useful method to find possible wastage of resources by bad prescription practice. It is also useful for measuring effectiveness of certain policy. For example (Prokeš and Suchopár 2008) measured how giving financial limits on drug prescriptions without giving guidelines how to meet those limits can decrease usage of overused drugs, but also of essential drugs, and therefore can have negative effects for the overall health outcomes. The study also identifies most usually overused drugs in Czech Republic and compares their usage with Scandinavian countries, which have long tradition of rational pharmacotherapy programs, to prove this hypothesis.

(Godman et al. 2011) compares overall utilization/expenditures ratio for key drugs across European countries to evaluate drug related policies and country specific

aspects. (Grand, Hogerzeil, and Haaijer-Ruskamp 1999) reviews drug use policies on a worldwide scope.

This method seems very useful and it might be a beneficial analysis, however it is discussable how much of the usage deviation is caused by legit reasons and how much is actually wasted. There are also discussions about which data sources to use, as prescription data from doctors data from pharmacies and data from patients are significantly different (Hoven, Haaijer-Ruskamp, and Stichele 2005; Ekedahl and Lindberg 2005)

Another set of studies is concerning prescription drugs abuse, dependence and misuse. We will follow definitions of (Compton and Volkow 2006) and consider abuse as an intentional use of intoxicating drug apart from medical treatment. Misuse will be considered as accidental non-medical use of drugs and dependence will be understood as physical dependence on a drug (experiencing physical symptoms after withdrawal). Drugs that are often abused and that are considered to be the biggest problem are opioids, which are used as pain medication. Their use in pain treatment is essential, however overtreatment can cause addiction or dependence to these drugs (Čížek 2002; Compton and Volkow 2006; Strassels 2009). (Joranson DE 2000; Gilson et al. 2004) look for trends in medical use and abuse of prescription opioid analgesics in the USA and also study ways of diversion of these drugs. They uncover that prescription drugs use and abuse is quickly rising, however not proportionally to drug abuse in general. They also find out that there are no solid data on to which extent are prescription drugs actually diverted. (Gilson and Kreis 2009) reviews literature on non-medical use of opioid drugs in general. It analyzes different sources of data and their different methods of collection of data, which are not therefore comparable. It also discusses the terminology and its inconsistency in usage. It also looks, as well as (Strassels 2009) for literature on estimating the costs of opioid abuse. Some of the literature focus on direct health care costs (White et al. 2005) and some are also including other costs, like crime consequences and loss of productivity (Birnbaum et al. 2006; Birnbaum et al. 2011; Hansen et al. 2011). (White et al. 2005) tries to estimate extra per-patient direct medical costs caused by prescription opiods abused in the USA per year. It links together insurance claims from opioid abusers with randomly selected matched sample (by demographic data) of non-abusers and compares per-patient average costs. Study also uses multivariate regression to control for other variables and to compare the costs to depression patients. The result was that average per-patient medical costs of abusers were 8 times higher than costs of non-abusers per year, mainly caused by higher utilization of prescription drugs and medical services. (Birnbaum et al. 2011) tried to estimate overall economic costs in

the USA in 2007. To calculate overall direct medical costs it used the same approach to estimate extra per-patient costs and then multiplied it by total number of opiod abuse patients from national statistics. It also estimates costs of criminal justice and productivity loss. Excess medical and prescription costs totalled $23.7 billion dollars (around 42% of total estimated costs). (Hansen et al. 2011) tries to estimate the same however focusing more on the non-medical part. It apportions only 4% (around $2.2 billion) to direct medical costs however it counts only abuse treatment costs, while (Birnbaum et al. 2011) uses also average extra overall medical expenditures of opioid abusers. In both studies they calculate abuse treatment costs by collecting national estimates of expenditures to treatment of mental health and substance abuse disorders and then apportioning them to non-medical use of opiods by using statistics of National Survey of Drug use and Health.

This method seems interesting. The non-medical use of prescription drugs is clearly wastage of resources, but nobody is able to estimate how much of prescription drugs is actually abused. It is discussable if the treatment of prescription drug can be considered wastage of resources, but at least this number can be easily estimated. The total economic burden of abuse is clearly an unfortunate loss of resources. It seems that this problem can be better manageable and that there are policies that can help mitigate the abuse, like better determining the risk of abuse in chronic pain patients (Turk, Swanson, and Gatchel 2008), so high level of prescription drug abuse might be seen as healthcare inefficiency.

It seems that there are available data even in Czech Republic. For example the Drug Epidemiology Headquarters of the Hygienic Station of the Capital Prague publishes reports with drug related statistics like number of opiate abuse patients etc. (Seblova et al. 2005) introduces this data source and also discusses the overall trends in substance abuse in the Czech Republic. It is certainly a viable method of estimation in Czech Republic.

2.7 Case studies

Last type of studies focuses on cases of uncovered corruption or resources misuse to show how corruption occurs and how much of the resources are wasted. They usually review the facts and processes in which inefficiencies occur and suggest policies to avoid these in the future. They are not trying to estimate overall leakages; however they can help us understand the process of corruption, overpricing etc.

(Nadační fond proti korupci and V97 s .r.o. 2012) is a nice overview of possible leakages of resources in Czech Republic including case studies, which could be useful to get at least a feeling of how much of the resources supposed for health care is wasted in Czech Republic.

2.8 Conclusion

There are a lot of different inefficiencies in healthcare, however estimating the extent of the losses in monetary terms is rare in the literature. Papers with clearest monetary results are (Brooks, Button, and Gee 2012; Psaty et al. 1999; Gibbons et al. 2010; Skinner, Fisher, and Wennberg 2005; White et al. 2005; Birnbaum et al. 2011). All of them seem to be applicable on Czech Republic. It is probable that for the analysis by done by Skinner, Fisher and Wennberg there is not enough data points in the Czech Republic to find reasonable results. However it could be applicable for example on European level. For the method used by (Psaty et al. 1999) we cannot use publically available data as DRG codes and their weights are not public. We will try to apply the rest on the Czech data to get an estimate of resource loss in Czech Republic.

3 Data

3.1 Sources

The source of healthcare data on Czech Republic that will be used throughout this thesis is Institute of Health Information and Statistics of the Czech Republic (ÚZIS). ÚZIS is a government institution officially run by The Ministry of Health of the Czech Republic (MZČR). The task of ÚZIS is to administer National Health Information System (NZIS), which should provide information on health and health facilities in Czech Republic. ÚZIS also cooperates with other information systems and should therefore be the most reliable source of data for calculations in this thesis.

Publication available at the website of ÚZIS will be used to collect data on healthcare expenditures, health of the population and prevalence of patients diagnosed with opiate drug abuse. Demographic information from Czech Statistical Office (ČSÚ) also had to be used for some of the calculations.

For international comparison we will use OECD data available in their publically available database *OECD .Stat extracts*.

Also estimates from various academic sources will be used in our calculations. (White et al. 2005) will be used for ratio of medical costs of prescription drug abusers to non-abusers as this cannot be calculated from publically available data. Results from (Brooks, Button, and Gee 2012) will be collected to estimate the scale of healthcare inefficiencies and fraud in the Czech Republic and (Gibbons et al. 2010) for estimation of costs connected to unnecessary C-section delivery.

3.2 Statistical description of Czech healthcare

In 2010 according to data from ÚZIS (Economic Information on Health care 2011) the total expenditures on Czech Healthcare were 289 billion CZK, which is 2.6 billion less than in the previous year. According to preliminary data from ÚZIS the expenditures had decreased in 2011 as well to 288.5 billion CZK. However in real terms the spending is slowly increasing due to the negative GDP deflator as we can see in figure 4

As stated in the report by ÚZIS, from the total expenditures of 289 billion in 2010 243.2 billion was public (84.2%) consisting of health insurance (222.5 billion CZK)

and public budgets (20.7 billion CZK) and 45.7 billion (16.4%) were private expenditures (*Economic information on health care* 2012). If we look at the trend of proportion of health expenditures according to source of financing in figure 5, we can see that private spending on healthcare increased in 2008 due to the introduction of regulation fees and that public budgets have declined since 2009, which is caused by austerity measures of the former Czech government.

Figure 4: Trend of real healthcare expenditures in Czech Republic
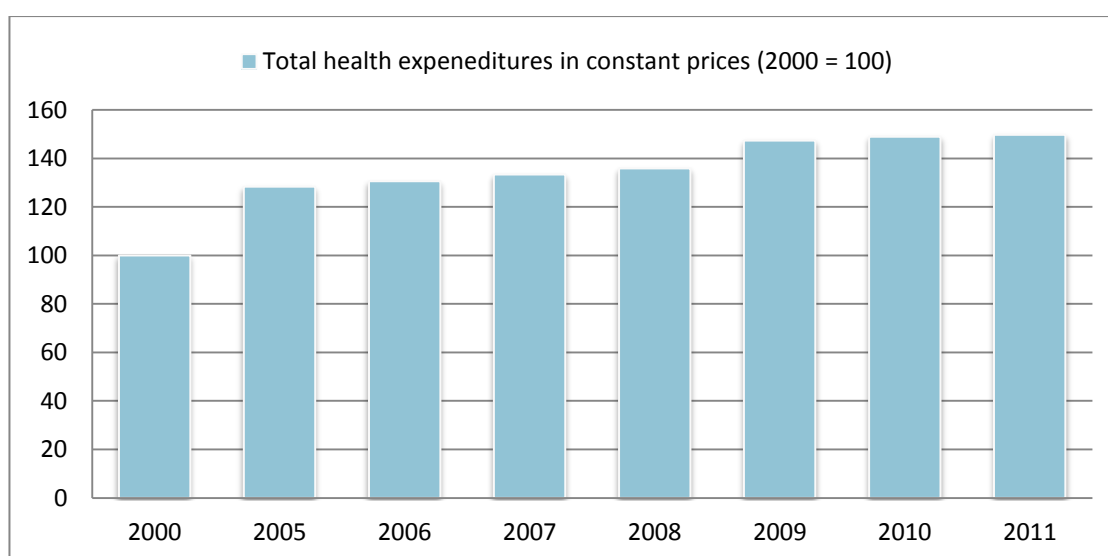
Source: ÚZIS Economic Information on Health care 2011

Figure 5: Share of expenditures according to source of financing by year
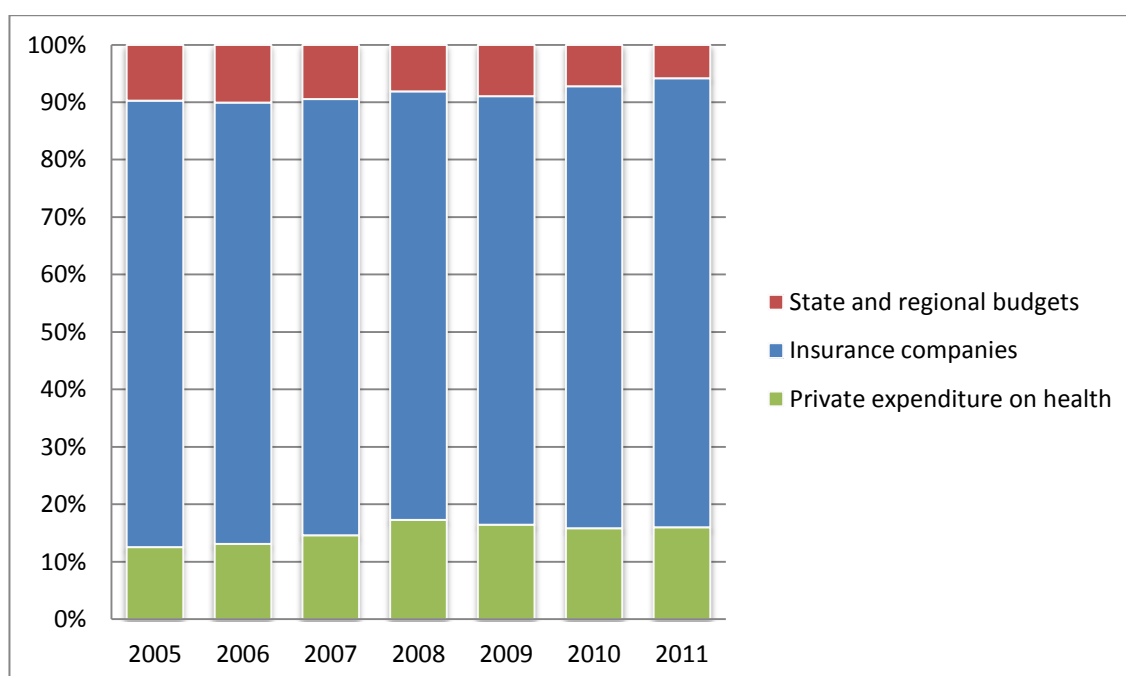
Source: ÚZIS Economic Information on Health care 2011

We will now break down expenditures on health care by insurance companies again according to data from ÚZIS (Economic Information on Health care 2011). From the total expenditures by health insurance companies of 222,5 billion CZK, 215 billion (96,6%) was actually spent on healthcare. If we accept the definition from insurance theory that all costs in excess of benefit payments are administration costs (Mathauer and Nicolle 2011), then the rest 7,5 billion can be considered as administration costs. Breakdown of individual costs is summarized in table 1 and figure 6

Table 1 Breakdown of health insurance companies (HIC) costs in 2010

	Million CZK	Share
Total HIC expenditures	222 500	100%
HIC health expenditures	215 019	96,6%
Administration costs	7481	3,3%
Outpatient	45 580	20,4%
outpatient GP	12 623	5,6%
other outpatient	32 957	14,8%
Inpatient	111 746	50,2%
Stomatological care	9 938	4,4%
Prescription drugs and medical aids	40 255	18%
Other	7 590	3,4%
Preventive programs	653	0,3%

Source: ÚZIS Economic Information on Health care 2011

Figure 6: Health care costs covered by health insurance companies
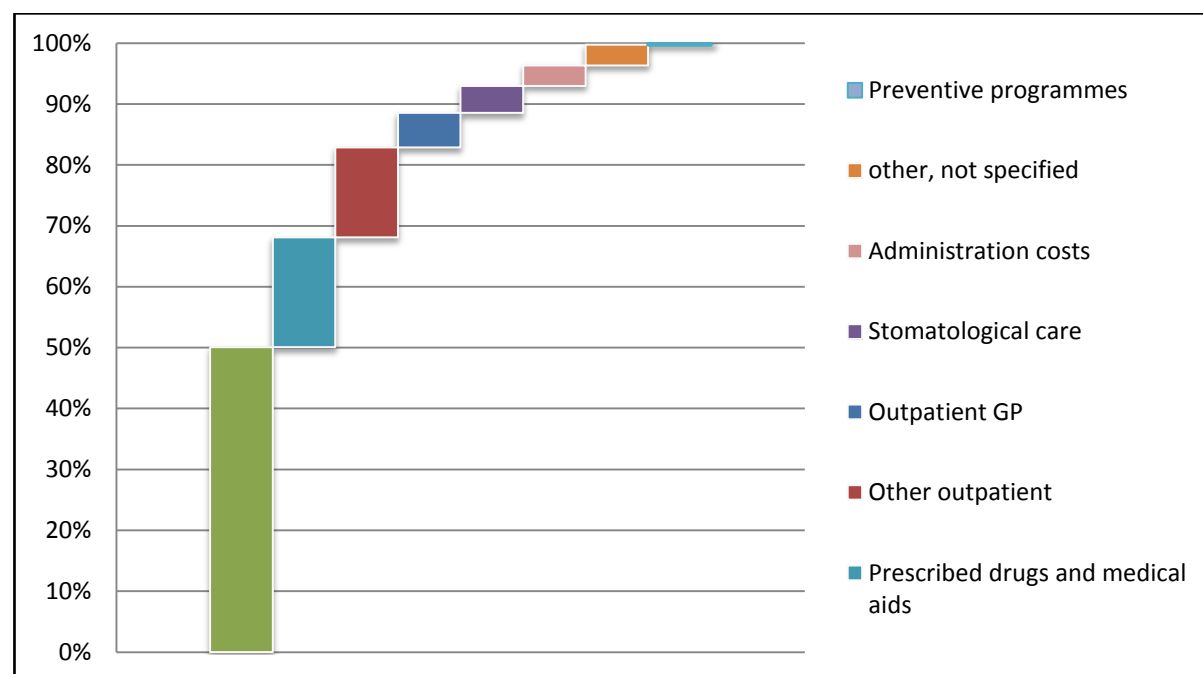
Source: ÚZIS Economic Information on Health care 2011

We can see that the administration costs amounted to 3,3% of total insurance expenditure. This is only marginally higher than the range of 2,9-3,2% that (Mathauer and Nicolle 2011) discovered between 2003 and 2007. If we compare it with the data on high income countries with social security schemes from the same paper, we will see that this is a good result. Only Estonia (1,1-1,9) and Hungary (1,5-2%) had strictly lower costs than Czech Republic in the same time period. We might conclude that Czech Republic does not have a problem with excessive administration costs.

If we consider that the VAT on drugs and medical aids was 10% in 2010, we can calculate that 3,65 billion CZK leaked out of the health care system in taxes for drugs. VAT on drugs increased twice since 2010 and is currently at 15%. If the spending on drugs and medical aid remains similar it would mean 5,24 billion CZK from the expenditures that would be spend on taxes and not actual care. The new VAT law is applied since 1. 12. 2013 and a lot of medical aids were moved from the lower rate of VAT into the higher one which was also increased from 20% to 21%. This means that hospitals will have to pay even more on taxes in 2013. According to the law, provision or sale of drugs and medical aids is subjected to VAT, yet their usage during direct provision of health care is not subjected to the tax and is considered as a part of the costs of service provided. That means that the VAT on drugs is paid either by drug supplier from the price that health care providers pay or by pharmacies and care providers during sale or provision of drugs to patients. Either way the health insurance costs of drugs and medical aids are going to be inflated by VAT tax and therefore our calculation should be correct.

According to the VAT law the provision of health care services is not subjected to VAT if it is provided by authorized subject, and is designed to improve health or prevent worsening of health. This means that services like eyesight tests for driving license etc. are taxed. Therefore the actual tax paid is even higher. This distinguishing of health care services can cause confusion which services to include as analyzed by (Křížová 2012).

 It is also surprising how little is spent on preventive programs (0.3% of all expenditures). However it is possible that some preventive programs are financed by the state and regional budgets. Investing in such programs and developing more predictive and personalized medicine could have significant returns and also improve quality of care in Czech Republic (Kinkorová and Topolčan 2012).

The biggest part of the health insurance costs was inpatient care. According to (Háva 2012), it is quite possible that the inpatient care costs are inflated by hospitals directly

ran by Czech Ministry of Health (MZČR). (Háva 2012) found out that claims on inpatient care between 2000 and 2010 in MZČR hospitals covered by health insurance were higher than actual costs on inpatient care, while in other hospitals they were lower or equal. For those 10 years this overpayment totaled 49.73 billion CZK (5.18 billion in 2010). This was deduced simply from comparison of published data by ÚZIS. Impulse for (Háva 2012) was an information from one of the workers at MZČR that Czech hospitals co finance their education programs from the system of public insurance.

We will now break down the costs even further and look how are money spent in Czech hospitals. We collected data from ÚZIS (Economic Information on Health care 2011) on all public and private hospitals in the Czech Republic in 2011. Data are summarized in figure 7.

Figure 7: Breakdown of costs in Czech Hospitals in 2011
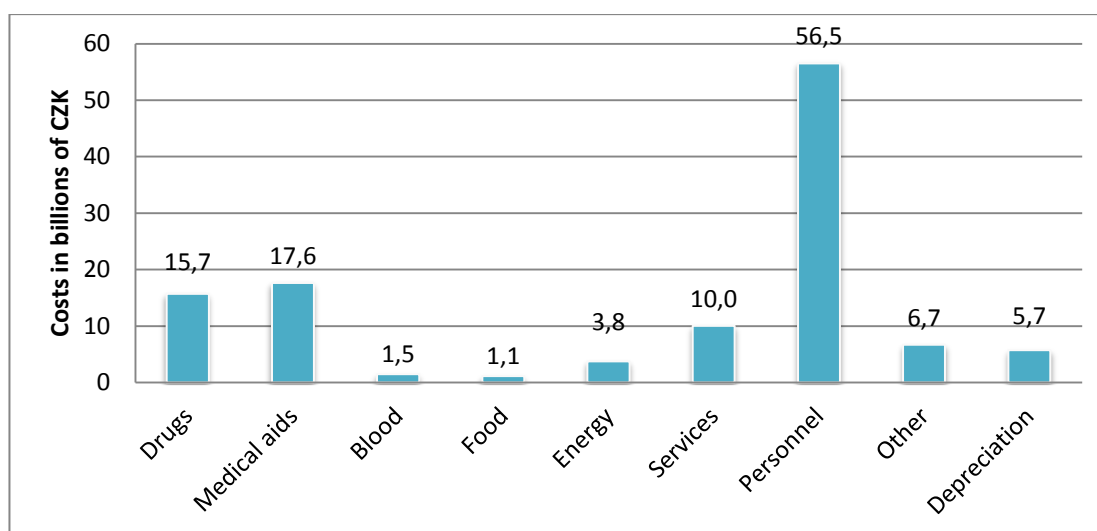
Source: ÚZIS Economic Information on Health care 2011

Total hospital costs were 126,7 billion CZK. Private and religious hospitals accounted for 36% of these costs and public hospitals for the rest. The highest share of total costs 44% is spent on personnel (56.5 billion CZK) then 14% (17,6 billion) is spent on medical aids and 12% (15,7 billion) on drugs. These three highest components of costs must have increased even more in recent years as there was a rise of salaries in 2012 (MZČR 2011) and increase of VAT on drugs and medical aids. This puts further pressure on hospitals to save money and be more efficient. However it can sometimes be dangerous for the health of patients to put pressure on saving without providing a concept of how to achieve them as seen on evidence from prescription drug limits in 2006 (Prokeš and Suchopár 2008).

We can again apply VAT to estimate how much is paid on taxes. The discrepancy between drugs and medical aids on which hospital pays VAT should not matter here as VAT should be accounted in costs either way. We will again apply 10% for 2010 and 15% to see how costs could look in 2013. That gives us a tax of 1,6 and 2,29 billion CZK on medical aids 1,42 and 2,04 billion CZK on drugs respectively. Hospitals also have to pay VAT on the other smaller parts of the budget. Some medical aids will also be in the higher rate VAT in 2013 and, therefore the costs will be inflated even more.

Figure 8: Average monthly wages on selected groups in thousands of CZK
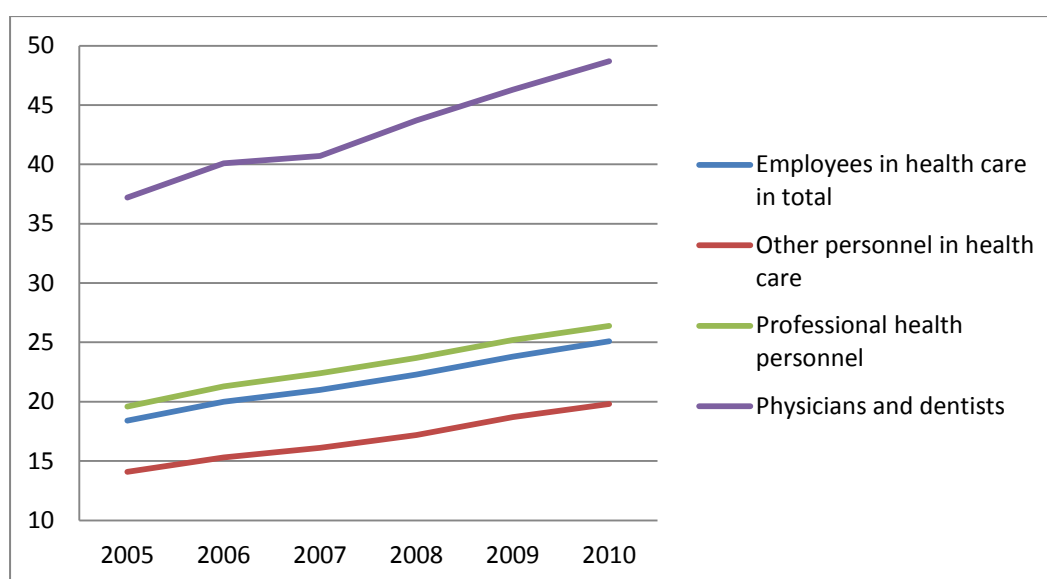
Source: ÚZIS Economic Information on Health care 2011

According to ÚZIS report on estimation of the average wage in whole healthcare between 2005-2010 the average annual growth of wages between 2005 and 2010 was 6,4% in nominal terms and 3,5% in real terms (see table 2 and figure 8). From the MZČR statement (MZČR 2011) it is clear that nominal wages had risen in 2012 however it is not clear how much as public data are not available yet. The MZČR statement also recognizes that the budgetary pressure on hospitals can have negative effects on the quality of provided care, which is further supporting findings of (Prokeš and Suchopár 2008).

3.3 Cross country comparison

In this section we will compare OECD data on health from their public database. In some of the measures we will follow interpretation of (Garber and Skinner 2008).

If we compare OECD data on spending on health care, Czech Republic has one of the lowest health expenditures both as a share of GPD and per capita amongst OECD countries. This can have various explanations and it is not clear straightaway whether it is a good or a bad sign.

Table 2: Average gross monthly wages in Czech Healthcare by type of worker in CZK

| Category of employees	2005	2006	2007	2008	2009	2010
Physicians and dentists	37 200	40 100	40 700	43 700	46 300	48 700
Pharmacists	28 200	30 100	30 600	32 800	34 200	35 900
Paramedical workers with professional qualification	17 200	18 900	20 000	21 100	22 600	24 000
Paramedical workers with professional and specialized qualification	17 900	19 400	21 100	21 900	23 500	24 400
Health care workers pursuing paramedical profession under professional supervision or direct guidance	13 000	13 900	14 800	15 500	16 400	16 700
Other professional workers in health care and dentists without university level	22 200	23 600	25 300	27 000	28 000	28 400
Professional health personnel	19 600	21 300	22 400	23 700	25 200	26 400
Pedagogical personnel and technical and economic personnel	19 600	21 200	21 900	23 300	25 600	27 400
Manual workers and operational personnel	10 800	11 500	12 300	13 000	14 000	14 300
Other personnel in health care	14 100	15 300	16 100	17 200	18 700	19 800
Employees in health care in total	18 400	20 000	21 000	22 300	23 800	25 100

Source: ÚZIS Economic Information on Health care 2011

One explanation can be that Czech healthcare provides less intensive care than other OECD countries. To compare intensity of care, (Garber and Skinner 2008) used data on practicing physicians per 1000 people, number of acute hospital beds and number of MRI's per million people (see figure 3 in section 2.).

We collected data on those indicators from OECD database (see table 4) and found out that Czech Republic has above OECD average acute beds per 1000 people and slightly above average number of physicians per 100 people. However the health employees per bed ratio is below average so even though the inpatient care might be more frequent it seems that it might be less intensive than in other countries. The bellow average number of MRI machines per million inhabitants (5, 72 in 2009, 6, 4 below average) also suggests that Czech health care is not technologically intensive. This might be one of the reasons why the expenditures on healthcare are not that high. However OECD database did not publish data on this indicator for most OECD countries so we used OECD data on European countries to get a better comparison (OECD Health at Glance: Europe 2012). The results confirm, that amount of MRIs per million people in Czech Republic was below average of most developed countries (figure 9) .

It also could be interesting to compare the average wages of physicians. We collected average annual income of medical specialists from OECD in PPP USD as a measure of comparison. According to the available data

Figure 9: MRIs Europe comparison
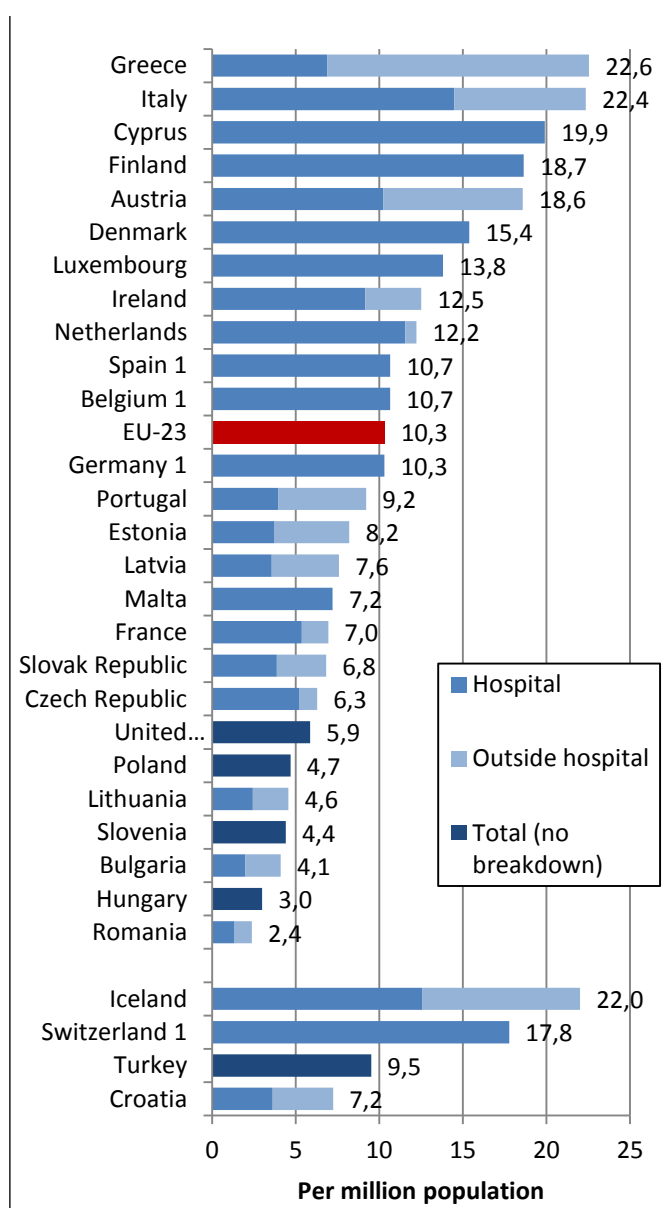
Source: OECD Health at Glance Europe 2012

(see table 3) the average income of Czech medical specialist in 2009 was second least after Hungary amongst the OECD (42% of the average) and was also second smallest (after Norway which had above average absolute income of medical specialists) when compared to per capita GDP (1,55 while the average was 3,11). As personnel costs have the biggest share amongst hospital costs in Czech Republic (44%), this might be one of the reasons why Czech relative healthcare expenditures one of the smallest amongst OECD countries. From this fact we might also hypothesize that Czech hospitals are relatively underfunded.

Table 3: Comparison of average annual incomes

of medical specialists

Country	Avg. income to GDP per capita
Czech Republic	1,55
Denmark	3,33
Estonia	2,19
Finland	2,9
France	2,51
Greece	2,81
Hungary	1,71
Iceland	2,5
Ireland	5,75
Israel	3,38
Italy	2,84
Mexico	3,4
Netherlands	3,3
New Zealand	3,95
Norway	1,53
Slovenia	3,38
Turkey	5,92
United Kingdom	3,17

Source: OECD Public Database, http://stats.oecd.org/

We tried to explain the relatively smaller health care expenditures, but the expenditures alone will not tell us anything about efficiency. If we would measure that some country has lower health care expenditures than other and produces the same or better health outcomes, while controlling for non-medical determinants of health, we might conclude that its healthcare is relatively efficient. This logic is used in methods of (Fisher et al. 2003; Skinner, Fisher, and Wennberg 2005). However

there are proxies which are used by (Garber and Skinner 2008). One of them is utilization of influenza immunization by people older than 65. According to (Garber and Skinner 2008) this is a highly cost-effect treatment that indicates efficiency of the system.

We collected data on this proxy from OECD immunization data. The most recent Czech entry was in 2008. Czech Republic ranked last amongst OECD countries that had available data for 2008 (figure 10, table 4). This is not a good result for Czech Republic, but we still have to understand that this is just one of the proxies for efficiency. This indicates that Czech Republic is still lagging behind other countries in better preventive and therefore cost-effective care. This is consistent with (Kinkorová and Topolčan 2012) which states that Czech personal and preventive care is lacking any long term concept.

We should also compare health outcome before we make any conclusion. This is usually done by comparing survival rate of certain disease (Garber and Skinner 2008). We selected breast cancer treatment 5 year survival as it is indicated in the OECD database as an appropriate measure. Between 2001 and 2003 Czech Republic ranked either last or second to last amongst OECD countries that had available data surpassing only Poland in 2002.

From this quick comparison, it seems that Czech healthcare is underfunded rather than cost-effective. Other possible explanation is that the demand for healthcare is lower than in other countries. Either way it seems that the smaller expenditures on healthcare go hand in hand with lower quality healthcare.

Figure 10: % of population aged 65+ Immunizied against influenza - 2008

Source: OECD Public Database, http://stats.oecd.org/
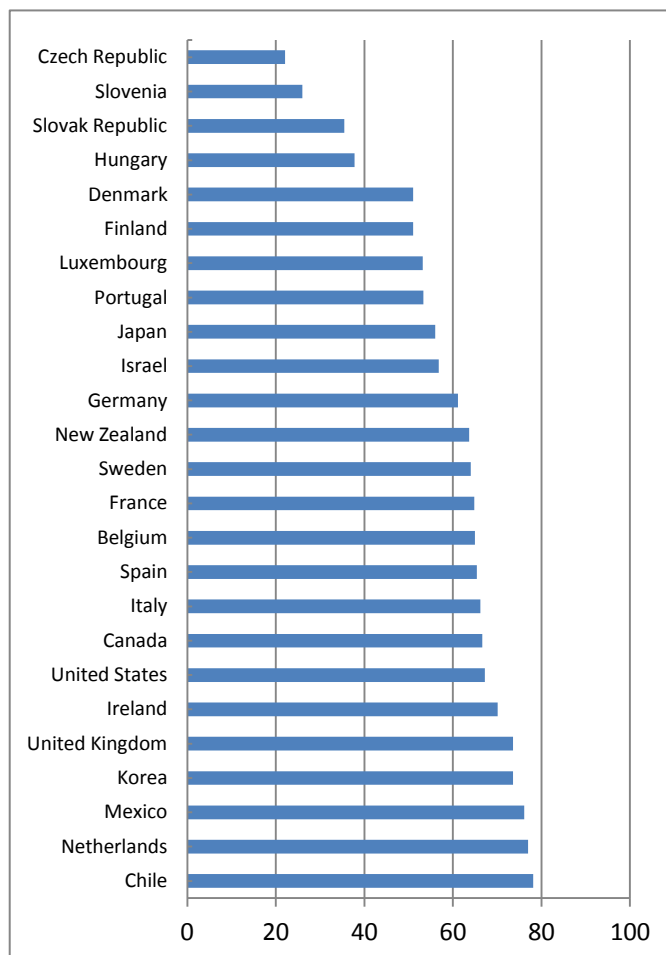
Table 4 Comparison with selected OECD countries

Country	Total expenditures as a share of GDP 2010	Per capita health expenditures in USD PPP 2010	Physicians per 1000 population 2009	Acute hospital beds per 1000 population 2009	MRIs per million population	% population aged >65 with flu shot 2008
Australia	8,9	3800	3,1	3,76	5,69	M
Austria	11,0	4457	4,68	7,66	18,41	M
Belgium	10,5	3964	2,92	6,51	7,89	65
Canada	11,4	4445	M	2,68	M	66,6
Czech Republic	7,4	1884	3,56	7,11	5,72	22,1
Denmark	11,1	4495	3,48	3,49	15,39	51
Estonia	6,3	1273	3,27	5,35	7,46	1,1
Finland	9,5	3437	M	6,25	15,73	51
France	11,7	4016	M	6,66	6,43	64,8
Germany	11,5	4348	3,64	8,24	M	61,1
Greece	9,5	2623	M	4,85	21,71	M
Hungary	8,0	1656	3,02	7,14	2,79	37,8
Iceland	9,3	3298	3,65	3,73	21,93	M
Ireland	9,3	3780	M	3,27	11,89	70,1
Italy	9,4	3018	3,68	3,63	21,2	66,2
Japan	9,6	3213	M	13,67	M	56
Korea	7,3	2086	1,92	8,21	18,79	73,6
Mexico	6,2	976	2,05	1,67	M	76,1
Netherlands	12,1	5028	M	4,66	M	77
New Zealand	10,2	3042	2,57	2,4	M	63,7
Norway	9,4	5413	4,02	3,35	M	M
Poland	7,0	1394	2,17	6,65	M	M
Portugal	10,8	2766	M	3,35	M	53,3
Slovak Republic	9,0	2094	M	6,51	M	35,5
Slovenia	8,9	2363	2,41	4,6	M	26
Spain	9,6	3033	3,54	3,19	M	65,4
Sweden	9,5	3716	3,8	2,76	M	64
Switzerland	10,9	5299	3,83	5,1	M	M
United Kingdom	9,6	3421	2,71	3,34	M	73,6
United States	17,7	8246	2,44	3,08	M	67,2
Average	9,8	3420	3,1	4,89	12,2	56,7

Source: OECD Public Database, http://stats.oecd.org/

4 Estimates of inefficiencies

From the methods discussed in the literature review those were selected that result in an estimate of inefficiency in monetary terms that can give us a picture of how many resources are wasted in a certain area of health provision in the Czech Republic.

4.1 Audits

First of all we will look at Czech healthcare as a whole and try to get a rough estimate of how big the losses of resources might be altogether. The most precise way to estimate this is to perform an audit in healthcare and look for possible frauds or errors in procurement, hospital management, expense claims etc. If a statistically valid sample is audited the results can be extrapolated on the whole population. To my knowledge, there is no such measurement of erroneous or fraudulent behavior in Czech healthcare system. Most studies, using this method, on a global scale were conducted in the USA ordered by the federal or state government. However (Brooks, Button, and Gee 2012) found 69 measurements of frauds and errors from 33 organizations in six countries, namely the United States, the United Kingdom, France, Belgium, The Netherlands and New Zealand that fulfill following criteria:

- *have considered a statistically valid sample of income or expenditure;*

- *have sought and examined information indicating the presence of fraud error or correctness in each case within the sample;*

- *have been externally validated;*

- *have a measurable level of statistical confidence; and*

- *have a measurable level of accuracy.*

This should give us an idea about the goals of these individual measurements and also their statistical validity. (Brooks, Button, and Gee 2012) analyzes results of these measurements to get a possible range of healthcare losses that we could encounter in global scale. They used only the first and most recent measurement from each source to avoid skewness due to higher proportion of data from one source. The logic behind

this is that frauds and errors are usually reduced significantly after the first measurement so using only first or only last measurement could possibly cause a bias.

From the 69 measurements average proportion of expenditures lost to fraud and error was 5,59 percent with lowest estimate being at 3,29 percent and highest at 10 percent. We followed interpretation of (Brooks, Button, and Gee 2012) and applied these rates to 2010 total health expenditures in Czech Republic. The results were 9,5 billion, 16,1 billion and 28,9 billion in 2010 CZK respectively. Results are summarized in table 5.

Table 5: Results of audit data application

	Estimated proportion of expenditure lost to fraud and error *	Estimates of losses in Czech healthcare in 2010 in million CZK **
Highest	10%	28 900
Average	5,59%	16 100
Lowest	3,29%	9 500

Source: * Brooks, Button and Gee 2012, ** ÚZIS Economic Information on Health Care 2011

(Brooks, Button, and Gee 2012) also listed some of the specific areas where losses have been measured:

- *the fraudulent provision of sickness certificates;*

- *prescription fraud by pharmacists;*

- *prescription fraud by patients;*

- *fraud and error concerning capitation payments to GPs;*

- *fraud and error concerning payments made to doctors to manage a patient's medical care;*

- *the evasion of dental charges by patients;*

- *fraud and error by opticians concerning the provision of sight tests;*

- *fraud and error concerning employees of health-care organizations;*

- *fraud and error concerning payments for in-patient hospital services.*

Unfortunately distribution of losses according to these specific areas of healthcare was not available. Nonetheless, this can help us understand what kind of inefficiency these measurements can uncover. Audits focus mainly on frauds and errors, but they do not try to estimate the underlying costs that might be connected to them. They also do not estimate inefficiencies that are not strictly connected to frauds and medical errors.

Following the interpretation suggested in (Brooks, Button, and Gee 2012) we might conclude that losses in Czech healthcare due to frauds and errors in 2010 were most likely higher than 9,5 billion CZK, probably around 16,1 billion CZK and could amount to 28,9 billion CZK. This might seem as a wide range; however without a solid measurement conducted in Czech healthcare we cannot find a more precise estimate of overall resource loss.

The results of these measurements are also usually considered as an understatement as it is impossible to uncover 100 percent of frauds so the actual level of resource wastage can be higher. Nonetheless the amounts are still economically significant. One fifth of the studies measured losses to be more than 8 percent. This method also does not measure all inefficiencies in healthcare; there are areas in which healthcare provision can be inefficient without being subject to fraud or error. Also when we consider that these studies were conducted in economically more developed countries than Czech Republic, we can ask ourselves how high the actual losses in Czech Republic can be.

These studies can uncover a lot of possible frauds and errors that can be fought by better policies or better enforcement. Performing this measurement requires high level of resources; however the experience from the UK shows that if the measurement is followed by action it is actually very cost effective tool. Since 1998 till 2004 the Counter Fraud Service in the UK, using measurement and tracking of losses as their starting point, had a 13:1 return on its budgetary investment by recovering resources lost to frauds and reducing the measured losses due to interventions (Gee 2006). This shows that that using this method in the right way can bring a lot of benefits and can be a good investment.

4.2 Prescription drug abuse, dependence and misuse (Opiod analgesics evidence)

In this section the methods used in (White et al. 2005; Birnbaum et al. 2011) will be used to estimate excess medical costs due to nonmedical use of prescription opioid analgesics. In this section we will use drug abuse and drug abuser for all nonmedical use of opioids, unless we want to further specify. Definitions of abuse, dependence and misuse can be found in section 2 of this thesis. We will use the estimate from (White et al. 2005). According to this study, patients diagnosed with opioid abuse (excluding heroin abuse) has a mean annual direct health costs more than 8 times higher than non-abusers. It collected data on administrative claims for approximately 2 million insured people from 16 large employers with a wide variety of activities and employees across the whole USA. Those diagnosed with opioid abuse or dependence (N=740) were selected and matched 3:1 with a randomly selected group of non-abusers that had the same distribution of age and location (N=2 220). Claims from half a year before and half a year after the diagnosis were collected. Then annual costs were calculated from the claims collected and averaged.

We tried to replicate this for the case of Czech Republic. We do not personally have such access to medical data, but it is possible that Czech insurance companies have medical claims database that can be used for further study. Due to the absence of data we will assume that the mean annual direct medical cost of people diagnosed with opiod abuse or dependence (excluding heroin and combination of drugs abuse) is 8 times higher than that of average insured person with similar age and sex distribution with accordance to the estimate of (White et al. 2005). The fact that we include the opiod abusers in the insured population can cause overestimation of the excess medical costs; however the amount that diagnosed opioid abuse and dependence adds to average medical costs of the whole population should not be significant.

We collected data on prevalence of abusers according to age and sex from ÚZIS report on psychiatric care based Data on drug abusers that were diagnosed and have active reports (not older than one year) in registry in out-patient psychiatric care facilities were used for our purpose. The data is summarized in figure 11.

Figure 11: Patients registered by psychiatric care providers as opiod abusers in 2011 in Czech Republic by age and sex
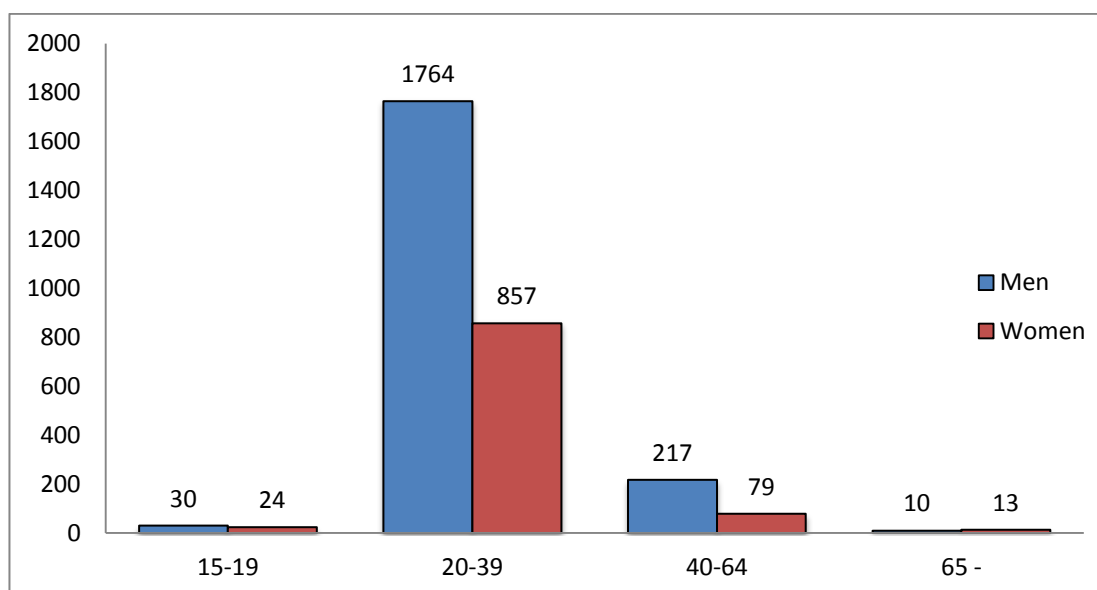
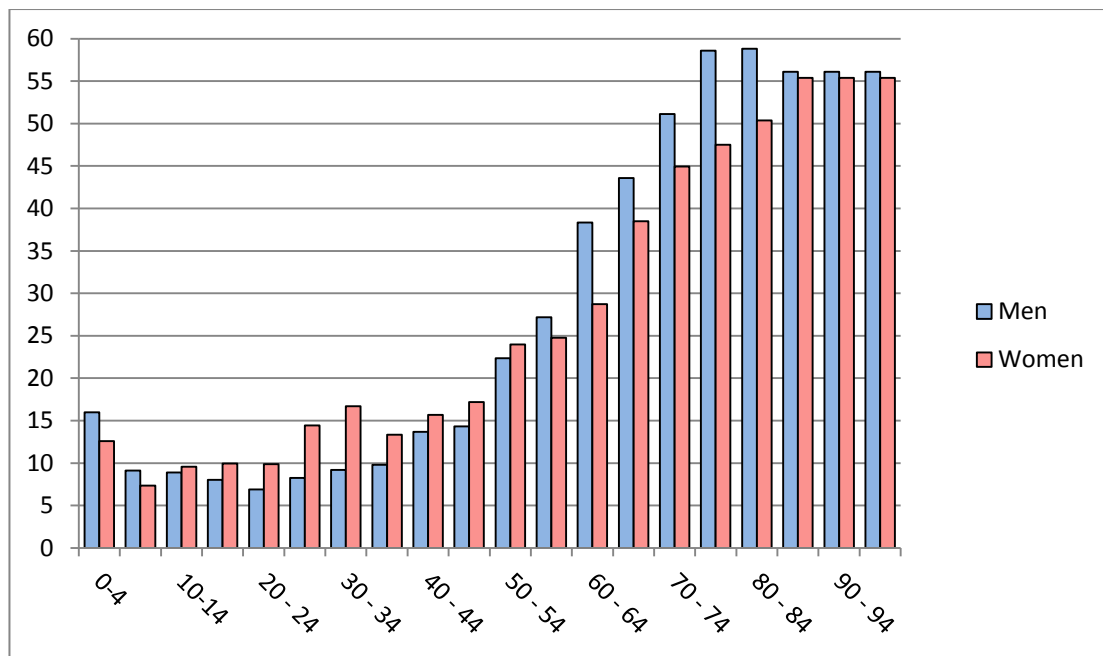Source: ÚZIS Report on Psychiatric Care 2011

As we can see, the majority of abusers were in the age group of 20-39 (87.5%), while more than half of the abusers in this age group were men (58.9%). Most opioid abusers in 2011 (excluding heroin) were treated in Prague (61.9%) second highest incidence was in Ústecký Kraj (15.5%).

We collected data on average health care cost covered by health insurance per 1 insured according to age and sex in 2010 from ÚZIS report on health care financing (figure12). These figures were reported in 5 year intervals. We therefore transformed them into intervals matching those from reports on drug abusers. This was done by using weights from the general population in the Czech Republic assuming number of insurers in selected age and sex group match number of inhabitants in the same category. Data on population by age and sex in Czech Republic in 2011 was collected from Czech Statistical Office. Average annual expenditures per 1 insured in appropriate age groups were then weighted by prevalence of opioid abusers to estimate average costs of non-abusers with the same demographics as abusers. This resulted in 11 823CZK per insurer in our group. If we apply the assumption that the abusers cost 8 times more than non-abusers we get that an average abuser annually costs 94 589 CZK. That means that the excess medical cost on 1 abuser is 82 766CZK.

According to (White et al. 2005) the excess medical costs were driven by higher inpatient (46%) and outpatient (31%) medical care and higher prescription drugs

utilization (21%). Drug abuse is also correlated with serious diseases like hepatitis or pancreatitis that might have been one of the reasons for higher costs.

Figure 12: Average insurance health expenditures per 1 insured by age and sex

Source: ÚZIS Report on Psychiatric Care 2011

We then apply a method used in (Birnbaum et al. 2011) which estimated average annual costs of abusers the same way as (White et al. 2005) and then multiplied the excess cost by an estimated number of people diagnosed as abusers or dependent from National Survey on Drug Use and Health in the USA. We will use the data on drug abusers we used above as those are to our knowledge the only official statistics on epidemiology of prescription opioid abuse and dependence. This gives us an annual cost of 247.8mil. CZK.

We must understand that the resulting amount is just a rough estimate. We used the estimate of (White et al. 2005) to calculate the excess medical costs, however it is possible that the excess medical costs might be different in Czech Republic. More precise estimate for Czech Republic might be derived from studying administrative claims from Czech health insurance providers. Also this study only estimates annual costs for abusers that were actually diagnosed. It cannot measure the costs of all prescription opioids abusers and losses due to diversion of prescription drugs. Yet it gives us an estimate that can be used and give us a good starting point for further study of prescription drug abuse.

This also estimates inefficiency in a different way than auditing. While auditing can uncover the loss of resources due to diversion or improper use of prescription drugs connected to abuse or dependence, this method estimates the underlying medical costs connected to it. And even though the estimated amount does not seem significant in the big picture of overall healthcare expenditures, I believe it is not negligible, especially when we consider that we did not account for productivity loss and criminal justice costs that are actually estimated in (Birnbaum et al. 2011), but are not in the scope of this thesis.

There are various ways to combat abuse of prescription drugs like studying measurable determinants of abuse, which can help us identify possible abusers sooner or adding certain substances into the drugs that cause undesirable effects while using excessive dosage (Gilson et al. 2004). Analysis of societal costs of abuse can be useful to determine whether such policy is cost-effective or not and can help us make better decisions.

It would also be interesting to look at the trend of opioid abuse in the Czech Republic. Data from ÚZIS on people diagnosed with opioid abuse were collected from 1997 till 2011.

Figure 13: Trend of nonmedical use of opioids in Czech Republic
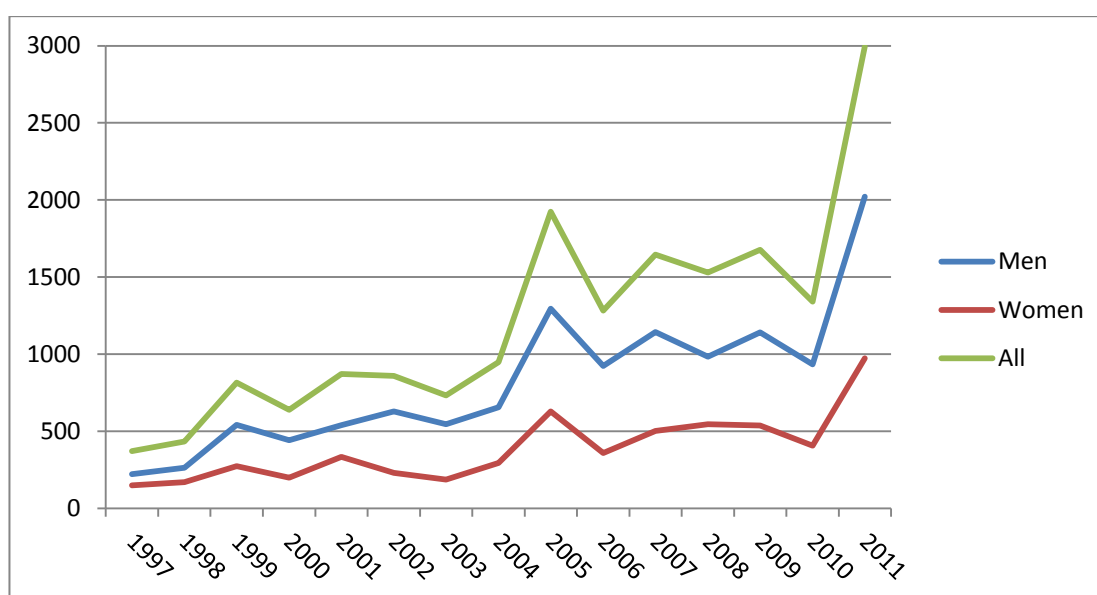
We can see in figure 13 that the amount of abusers increased between 2004 and 2005. However the data from 2011 are not comparable to the previous year due to the change in collecting data. Before 2011 methadone users, which were using methadone as a substitute treatment were included as heroin abusers therefore the number of heroin abusers that we subtracted from all abusers decreased in 2011. We

cannot treat those people as abusers (following the definition from section 2); however we can treat them as prescription drug dependent as (White et al. 2005; Birnbaum et al. 2011) involved dependence in their analysis as well.

4.3 Overuse of unnecessary procedures (Evidence from C-Section)

In this section we will discuss overuse of unnecessary procedures demonstrated by providing estimates on costs of unnecessary C-Section (CS) in the Czech Republic in 2011.

Prevalence of CS is highly controversial topic between physicians. In 1985 WHO made a statement that appropriate rate of births by CS should be between 10 and 15 percent. Apparently increasing CS rate up to 15% can increase medical benefits and reduces birth risks, while increasing CS rates above 15% can cause more medical risks and therefore it is medically unjustifiable. While some argue that this statement is outdated and rate of CS up to 30% is now justifiable due to advanced CS procedures (Barbieri 2004) others confirm that voluntary CS can cause bad health outcomes and defend the WHO threshold of 15% (Villar et al. 2006; Belizán, Althabe, and Cafferata 2007). We will therefore use the 15% as a benchmark for Czech Republic. Any CS above 15% will be considered as a medically unnecessary.

(Gibbons et al. 2010) did a worldwide estimation of unnecessary CS and their cost in 2008. They used the above mentioned threshold for number of unnecessary CS. For estimation of costs they calculated quantities of extra physical inputs that are required for CS compared to normal vaginal delivery. This profile of inputs was standardized and used for all countries. Also the estimate of resources required for establishing and maintaining the points of service for procedures above 15% rate of CS were added. Unit costs were derived from literature, databases and consultation with costing expert. The result for Czech Republic was 18,4% rate of CS with 3 706 unnecessary CS with estimated costs of 2 753 784 of 2005 USD.

Although we already have an estimate, we decided to apply this result on 2011 data to get more up-to-date results. Assuming that the physical inputs for CS have not changed dramatically, we will use the cost estimate from (Gibbons et al. 2010).After transforming 2005 USD into 2005 CZK using the exchange rate from 30th December 2005 we applied the GDP deflator, which is published and used for health expenditures by ÚZIS in publication "Economic Information on Health Care 2011" to get extra costs per unnecessary CS procedure in 2011 prices. This resulted in 16 945

CZK per CS. According to data from ÚZIS report on mothers and newborns, since 2008 the rate of CS increased from 21,9% to 23,7% in 2011. This however does not match the data from (Gibbons et al. 2010), which used 2006 WHO database (even though presented as 2008 data). This discrepancy seems strange; however we will stick to data from ÚZIS as they should be more reliable regarding Czech Republic.

Figure 14: Delivery by CS rate in Czech Republic
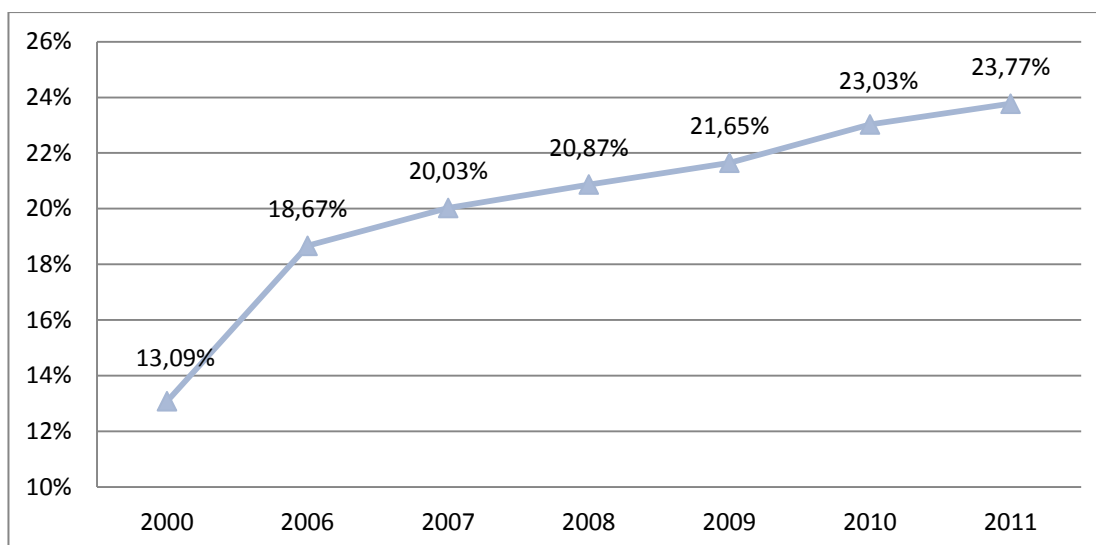
ÚZIS Report on Mothers and Newborns 2011

**Figure 15: Deliveries by CS in thousands in Czech Republic by year**
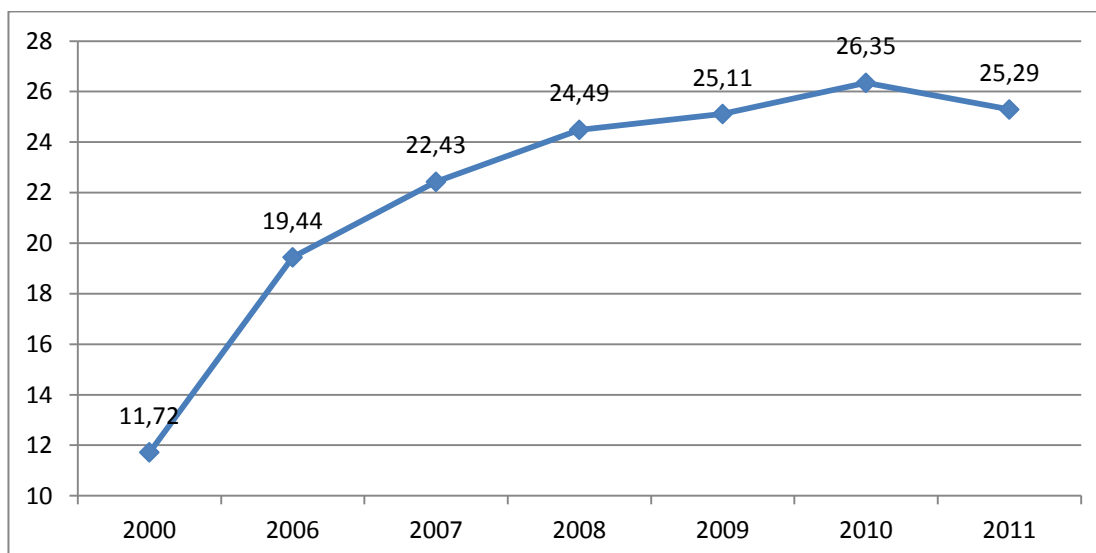
ÚZIS Report on Mothers and Newborns 2011

Using the 15% threshold on appropriate CS rate, we estimated that 9332 CS were unnecessary in 2011. By multiplying this with extra costs per procedure calculated above, we estimated that the unnecessary CS costs in 2011 were 184,4 million CZK.

If we compare our result with (Gibbons et al. 2010) we will surprisingly get a much different result. Using the data on CS from ÚZIS and the same unit costs as (Gibbons et al. 2010) we get costs that are more than 2 times bigger (6 171 864 of 2005 USD). This is of course caused by the discrepancy between CS rates caused by the use of 2006 data. There also seems to be a difference of few percentage points between the ÚZIS and WHO data on above mentioned years. However we believe that data from ÚZIS using National Registry of Mothers at Childbirth and National Registry of Newborns are accurate. The discrepancy is most likely caused by the scope of (Gibbons et al. 2010), which made them use one database with unified methodology and disregard inconsistencies between sources of data as different result of Czech unnecessary CS cost would change their overall result only by 0,14%.

Figure 16: Costs of unnecessary CS in millions of 2011 CZK per year and source of data
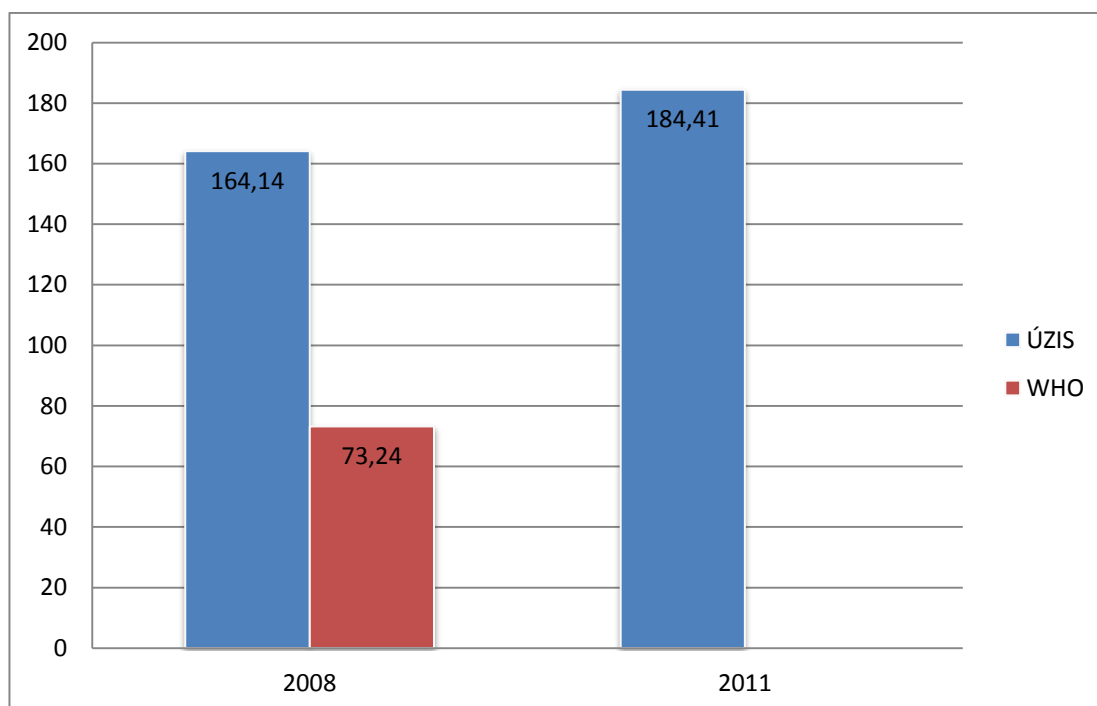
ÚZIS Report on Mothers and Newborns 2011, Gibbon et al. 2010, Author's calculations

Another problem with this estimate might be the unit costs estimated by (Gibbons et al. 2010). The difference in our estimates raises questions about how precisely are extra CS costs estimated. However without an analysis of these costs focusing on Czech Republic we cannot be sure how accurate the unit costs from (Gibbons et al. 2010) are. It is possible that per unit costs are a bit higher, because resources used to establish and maintain points of service for CS deliveries to the certain rate of CS above 15% were one part of the estimated costs of unnecessary CS.

Last factor that should make us be more cautious while interpreting these results is the above mentioned 15% threshold. As already discussed this threshold is from 1985 and the most of academic literature on topic of CS calls for further study.

The estimated amount might seem as insignificant considering the whole health expenditures (0,05%) we must understand that there are also health risks connected to unnecessary CS as discovered by (Currie and MacLeod 2013). Also if we consider the increase of CS rate since the year 2000 (almost 10%) these costs might become more and more economically significant in the future. The rate of CS has been increasing in the last decade even though actual number deliveries by CS declined due to decline in overall birth rate.

5 Conclusions

The whole problem of estimating the extent of inefficiencies in healthcare seems to be understudied as literature focuses rather on possible policies and discovering trends than on the estimation itself.

Some literature tries to estimate costs of narrower problems, like nonmedical use of prescription drug (White et al. 2005; Birnbaum et al. 2011) or use of unnecessary procedures like C-Sections (Gibbons et al. 2010). We applied these methods on Czech Republic and shown that it is possible to get a rough estimation while using just publically available data.

Apart from methods used for our estimates, we also found methods that could be applicable on Czech Republic, but due to the unavailability of proper data we could not apply them. An example could be (Psaty et al. 1999) regarding the problem of up-coding , which might cause problems in Czech Republic as well, because of the usage of diagnosis related groups (DRG) in Czech Healthcare.

Most helpful tool to measure inefficiencies, namely frauds and errors in payments for healthcare, seems to be auditing a statistically valid sample and extrapolating the results on the whole population. This could be a great instrument for limiting losses caused by error or fraud in Czech healthcare.

In table 6 we summarized all our calculated costs not going on provision of healthcare. However administration costs are usually not considered as a waste of resources as some level of administration costs is needed they are needed for the proper running of insurance companies

Table 6: Estimated values of resources leaking out of healthcare in millions CZK

Audit 2010	Opioid abuse 2011	C-Section 2011	Administration costs insurance companies	VAT - Drugs and medical aids 2010
9 500 - 28 900	247, 8	184,4	7481	3659,5

Source: Author's calculations

This thesis has shown that there are methods to estimate inefficiencies in healthcare and that with appropriate data they can be used in Czech Republic. Further study and

more precise estimates might be beneficial for decision making concerning these inefficiencies. Also, regular estimation can often uncover possible shortfalls in the system and help improve it. Hopefully, this thesis can serve as an inspiration for further study.

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