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ORGANIZATIONAL PERFORMANCE MEASUREMENT IN HEALTHCARE ORGANIZATIONS

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Abstract: In this paper the methods and techniques of performance measurement and their application for healthcare organizations are analyzed. The overview of the research in the field of performance measurement and, specifically, performance measurement in healthcare organizations, is done in order to reveal agenda for further research with regard to the case of Russian Federation. We argue that the operationalization the notion of "performance" in the models used for estimating of healthcare organizations' efficiency is not sufficient for its assessment that has to integrate professional, public policy and customer perspectives. It is shown that techniques applied in modern studies of healthcare organizations'performance allow for measuring of multi-input – multi-output productivity ,and, thus, they do not embrace all three perspectives of the healthcare organizations' performance.

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Introduction

Organizational performance is one of the most important constructs in management research. It is conventionally treated as an analysis of an organization's performance as compared to its goals and objectives (businessdictionary.com 2015). Within corporate organizations, there are usually three primary outcomes analyzed: financial performance, market performance and shareholder value performance.

This broad construct is essential in allowing researchers and managers to evaluate organizations over time as well as to compare them to rivals. As mentioned in (Richard, Devinney et al. 2009) organizational performance serves the most important criterion in evaluating organizations, their actions, and environments they operate in.

Performance is the contextual concept associated with the phenomenon being studied, thus, performance measurement is a simple concept without a simple definition. That is why the definition of "organizational performance" remains a surprisingly open question with few studies using consistent definitions and measures (Kirby 2005). Any writing on performance measurement provides a good working definition – it is common that each of these will be essentially the same thing in that its structure and definition are rarely explicitly justified; instead its appropriateness, in no matter what form, is unquestionably assumed (March and Sutton 1997).

There is a wide variety of the models to measure an organizational performance. The one widely used in research studies is the causal Performance Measurement Model (PMM). It is based on a respective meaningful description of how an organization operates. For the latter purpose the company's strategy need to be translated into a set of quantifiable cause and effect linkages between financial and non-financial indicators representing value creating activities and their outcomes. After the model is correctly constructed it becomes an instrument to measure and control the organization's performance, thus, enabling organization's management to guide the organization's performance.

In management studies performance might be measured in terms of process and/or in terms of outcome. The first one assumes cost-minimization of running the process under an implicit assumption that results of the process are provided at some acceptable for the organization level i.e., in regard to its goals and objectives. Process indicators used are designed to measure how well the organization runs its activities, and, hence, they reflect the organization's efficiency. The second assumes that organization is considered as the "production unit" which transform given inputs into outputs. Thus, in this case the input-output relationship in the ground is analyzed with emphasis on the produced outcomes. The outcome indicators measure to which extent the organization achieves the intended goals (results), i.e., describe the organization's effectiveness.

Moreover, measurement is not a neutral activity. It evokes considerable anxiety and frustration among all stakeholders: those who are being measured, those who are doing the measuring, and those who are seeking the data for a variety of purposes (Loeb 2004). Particularly, in case of healthcare organizations there is little agreement on the philosophy of measurement, on what to measure, on whether or how to adjust for what the patient brings to the clinical encounter, on how data should be analyzed, or on how to report the data; and of course on the ultimate questions related to the value of measurement (Loeb 2004).

In this paper we analyzed performance measurement techniques and their application for healthcare organizations (HCO). The overview of the research in the field of performance measurement and, specifically, performance measurement in HCOs, is done in order to reveal research agenda for further research with regard to the case of the Russian Federation.

Challenges of measuring healthcare organizations' performance

Increasing public interest in measuring performance of healthcare organizations (hereafter – HCO) is stipulated by shortages of human resources, growing needs in medical services generated by aging population and governmental demands of cost containment and accountability. All healthcare systems, independently of whether they are predominantly public, i.e., tax, social insurance-based, or market-based, have struggled for sustainability (defined as maintaining quality and service coverage at an affordable cost), particularly for the last decade. As pointed out in (Lega, Prenestini et al. 2013) "Maintaining funding levels that are appropriate to the technology innovation curve, the demographic-epidemiological curve, and citizen expectations is an unprecedented challenge for nearly all health systems. When the increase in supply costs must be covered by users, as in market-based systems, equity and access issues quickly emerge. Societies around the world are pressuring healthcare providers to reduce costs, while stakeholders are seeking improvements in the quality of and access to services. A neoliberal critique of public service provision has also increased awareness of the "patient as consumer", intensifying existing concerns about the quality and responsiveness of clinical services".

These factors place public HCOs under strengthening pressure to apply effective management tools. Nowadays, the development and implementation of performance measurement systems in HCO has been worldwide recognized an effective device for increasing HCO's accountability and quality, designing and implementation of organizational change (Zidarov, Poissant et al. 2014).

A significant part of the challenge in measuring HCO's performance in derives from the disparate nature of HCO (they are highly differentiated with regard to their medical profile) and variable perspectives represented among the key stakeholders. The latter is especially critical because of the potential conflict of stakeholders' interests representing professional, public policy and customer perspectives. As mentioned in (Loeb 2004) the professional perspective – held by some physicians, nurses, and scientists who are trained to think critically and analytically – claims that "performance measurement is simply too fraught with problems to be of much practical use". This position is augmented by numerous unresolved issues associated with the measurement process itself such as ambiguous data element definitions, complex algorithms, uncertainties about the psychometric properties of the measures themselves.

Public officials and regulators together with corporate purchasers of healthcare services are the main stakeholders in the public policy perspective. They stand for making performance measurement an integral part of the everyday business of healthcare and play a role of the key driving force for letting imperfect measures be used in the desire to move ahead with measurement, even though accuracy may be somewhat questionable. "In many respects, demands by purchasers and regulators for demonstrable evidence of quality, and demands for accountability, have become a major driver (if not the major driver) responsible for the burgeoning work in performance measurement over the past decade or so" (Loeb 2004).

The consumer perspective seeks for clear answers to vexing questions, despite the fact that in many cases sufficiently enlightened answers may not be available. Besides that the correctness of questions raised by the consumers is often a debating point itself. Consumers resonate with traditional measures of patient satisfaction (i.e. appointment waiting times, communication among caregivers); however, such measures are not standardized, hardly can be found in the public domain, and in many cases cannot be linked directly with the delivery of high quality healthcare services. Finally Loeb concludes that "these varying perspectives are often at cross-purposes with each other and, when taken together, demonstrate how difficult it can be to achieve consensus about performance measurement" (Loeb 2004).

The U.S. Department of Health and Human Services, Health Resources and Services Administration consider performance measures as the practical mean to set quality improvement goals and evaluate an organization's progress in meeting them. In the guidance on "Per-

formance Management and Performance Measurement" performance measurement is defined in a very practical way "as a process by which an organization monitors important aspects of its programs, systems, and care processes. Data is collected to reflect how its processes are working, and that information is used to drive an organization's decisions over time. Typically, performance is measured and compared to organizational goals and objectives. Results of performance measurement provide information on how an organization's current programs are working and how its resources can be allocated to optimize the programs' efficiencies and effectiveness (HSRA 2011). Performance measurement serves a reliable instrument to detect if an organization's current system is working well. There are a plenty of reasons to measure HCO's performance. Among them HSRA (HSRA 2011) names providing HCO management with possibility to: (a) distinguish what appears to be happening from what is really happening; (b) establish a baseline; i.e., measure before improvements are made; (c) make decisions based on solid evidence; (d) demonstrate that changes lead to improvements; (e) allow performance comparisons across sites; (f) monitor process changes to ensure improvements are sustained over time; (g) recognize improved performance. Besides that the HSRA guidance on "Performance Management and Performance Measurement" mentions additional reasons for US HCOs to measure its performance (HSRA 2011):

- Government-accrediting organizations and funding sources rely on performance measurement to prove resources are used effectively and efficiently.
- Clinicians use performance measurement to quantify the effectiveness of evidence-based care provided by their care delivery systems.
- Organizational leaders use performance measurement to monitor and improve management, clinical care, and support services.
- Fundraising is increasingly tied to documented performance.

The performance measures are categorized to better understand what systems or processes are measured. The typology of performance measures includes four categories (HSRA 2011):

- Process measure quantifies a healthcare service provided to, on behalf of, or by a patient, that is based on scientific evidence of efficacy or effectiveness. It quantifies a specific system; e.g., to get a test done or a service performed.
- Outcome measure quantifies a patient's health status resulting from healthcare. In the clinical area, it often measures a patient outcome so it can be compared to a care standard, such as, a patient's test value.
- Balancing measure ensures that changes to improve one part of the system are not causing new problems in other parts of the system. It another part of the system to ensure that improvements in one area have no unexpected consequences in another.
- Structure of care measure quantifies a feature of a healthcare organization (or clinician) relevant to its capacity to provide healthcare.

In healthcare organization such indicators as the number of patients treated, number of diagnostic procedures done, number of days spent by patient in a hospital, amount of drugs given to patients, etc., can be seen the process measures. Such metrics as mortality rate, percentage of aftereffects, average life-years after an operation, are the examples of outcome measures.

Obviously, analysis of the indicators representing only one category of performance measures separately from others, will not provide an adequate appraisal of the HCO's performance level. Complex, hence, multi-dimensional nature of performance requires to construct an integral measure of performance which would take into account in a consistent way all meaningful perspectives of the organizational performance.

Performance measurement techniques and their application for HCOs

Measurement of the variables that describe the true nature of service production is an important prerequisite for performance measurement. In healthcare, due to the nature of the services provided, it is often difficult to find the appropriate variables and to get them measured. Of course this depends on the level of analysis and whether it is carried out at the hospital level or the departmental level. Often, the measurements carried out at the departmental level cannot be aggregated into the single number hospital level measure. For example, units of measurement of services completed by chemical laboratory are different compared to those in radiology or in nursing units. Thus, when hospital level measures of departmental services are considered one has to be careful about what has been included in respective service production and ensure homogeneity of ultimate aggregate measure.

Defining and measuring the output at the hospital level varies considerably across providers by the volume and scope of services provided, and also by severity of patients' desease. Thus appropriate adjustments, such as case-mix adjustment, should be undertaken. In addition, outputs such as education, research, and certain community services may not be available in all hospitals. Lack of homogeneity in outputs produced and scale of operations may force one to conduct the performance analysis on those facilities considered peer-group organizations. Similarly, defining and measuring the inputs may pose difficulties as well. For example, differences may arise in pricing of input units, supply and materials or labor costs across facilities depending upon region. Similarly, capital assets valuation, depending upon when these are acquired and what type of depreciation rates are used, may render great variations in inputs.

In the last decades the frontier methodology has been widely adopted to compute the efficiency of healthcare management (Gattoufi, Oral et al. 2004). In particular, many authors have focused on distinguishing between non-parametric and parametric measures in order to define the best methodology to apply to the healthcare field (Hollingsworth 2003). Parametric techniques, such as the regression model, assume a specific functional form in defining the frontier and they are susceptible to model misspecification, whereas non-parametric approaches are not (Rosko and Mutter 2011). Moreover, another significant point about frontier methodology, i.e., Data Envelopment Analysis (DEA) or Stochastic Frontier Analysis (SFA), concerns the distinction between deterministic and stochastic approaches. The former do not contain a random error component and then they can be sensitive to outliers; the latter can separate inefficiency from random effect (Banker 1993). Nevertheless, the problem linked to the impact of extreme observations on the frontier can be solved through the envelopment map (Cooper, Seiford et al. 2002), the bootstrap methodology, and the sensitivity analysis (Cooper, Seiford et al. 2004).

In the literature, the most popular technique used to compute technical efficiency scores is the DEA methodology, which is a deterministic and non-parametric approach (Falavigna, Ippoliti et al. 2013).

This model does not require information on relative prices – differently from cost function models – and it is flexible and versatile. In addition, the DEA methodology can easily consider multiple inputs and outputs; whereas the SFA approach typically uses only one input (total cost) or output (total revenue). When the multivariate SFA is used, another problem occurs: how to combine residuals from different models (O'Neill, Rauner et al. 2008). Based on these considerations, many authors have applied the DEA approach to the healthcare field.

Sherman (Sherman 1984) was the first to apply the DEA methodology in order to measure the efficiency of seven US hospitals and his research has been followed by many applications considering other healthcare providers, i.e., physicians (Chilingerian and Sherman 1990, Chilingerian 1994), and nursing homes (Chattopadhyah and Ray 1996).

Briefly, the DEA methodology is an extension of linear programming which allows us to develop an efficient frontier for each DMU. The DEA estimation procedure consists of

solving for each DMU an optimization problem via linear programming. The efficient frontier is represented by convex combinations of efficient DMUs. The rest of inefficient firms or DMUs are "wrapped" by the efficient frontier considering that deviations from the efficient frontier are due to technical inefficiency (Alonso, Clifton et al. 2015). One of the main advantages of DEA methodology is that it allows considering multiple inputs and outputs simultaneously, which makes it particularly attractive in the case of hospitals. Additionally, it requires no assumptions about the functional form of the production frontier, which reduces the theoretical needs when specifying the model (Tiemann and Schreyögg 2009).

The first question that arises when selecting the model is its orientation, in the sense that either the inputs or outputs are considered exogenous and beyond the control of hospital management (Arocena and García-Prado 2007). Following O'Neill et al. (O'Neill, Rauner et al. 2008), hospital managers and policymakers have, in general, greater control over the level of inputs than output. O'Neill et al. (O'Neill, Rauner et al. 2008) also argued that, in most countries, the emphasis is more on controlling costs rather than on increasing demand of health services.

A second question of interest when formulating the model is the returns to scale assumption. In this paper, we assume variable returns to scale (VRS), which seems appropriate when we cannot assume that all DMUs are operating at an optimal scale. Following Jacobs et al. (Jacobs, Smith et al. 2006) and Tiemann and Schreyögg (Tiemann and Schreyögg 2009), in the hospital sector issues such as imperfect competition, budgetary constraints and/or regulatory constraints may result in DMUs operating at an inefficient scale size, thus assuming constant returns to scale may be a strong assumption.

A third question to deal with is that DEA efficiency scores have been subject of criticism because of their lack of statistical basis (Varabyova and Schreyogg 2013). Also, Simar and Wilson (Simar and Wilson 1988) proved that standard DEA estimates may be biased upwards. To overcome these problems, we employ the DEA homogeneous bootstrap methods described in Simar and Wilson (1988). Briefly, bootstrapping allows deriving statistical properties of efficiency scores through resampling, by estimating bias, variance and constructing confidence intervals (Simar and Wilson 1988).

In literature there were identified three groups of articles that deals with methods of frontier analysis and healthcare sector. They are: methodological papers which summarize and describe the peculiarities of the methods applied for assessment of efficiency and performance, methodological papers that analyze the most frequent and consistent indicators of HCO input and output, and empirical papers that assess the efficiency and performance of HCO or healthcare system.

There were 6 methodological papers discussing methods for assessment of efficiency and performance. The most frequent methods are divided into Data envelopment analysis (DEA) and Stochastic frontier analysis (SFA), (Rosko and Mutter 2011, Assaf and Josiassen 2015). However, A.C. Worthington (2004) identifies three groups: deterministic statistical frontier (DFA), SFA, and mathematical programming (including DEA etc.).

DFA derives a deterministic frontier through statistical techniques, such that all deviations from this frontier are assumed to be the result of inefficiency. This method supposes that there is no noise or measurement error. Such extensions are possible while using the dual-cost frontier, when the ability to incorporate multiple outputs is difficult. Moreover, if the cost frontier approach is employed, it is not possible to decompose inefficiency into allocative or technical components, and therefore all deviations are attributed to overall cost inefficiency. Several more limitations are that the method necessitates a large sample size for statistical reasons and the distribution of the technical inefficiency has to be specified.

The SFA removes some limitations of the DFA. It introduces a disturbance term representing noise, measurement error, and exogenous shocks beyond the control of the production unit. It permits the decomposition of deviations from the efficient frontier into two components, inefficiency and noise an assumption regarding the distribution (usually normal) of this

noise must be made along with those required for the inefficiency term and the production technology uses information on prices and costs, in addition to quantities, which may introduce additional measurement errors.

The programming approach differs from both statistical frontier approaches because it is nonparametric and in comparison to the SFA it is nonstochastic. It does not require (direct) accommodation for the types of bias resulting from environmental heterogeneity, external shocks, measurement error, and omitted variables. Deviation from the frontier is assessed as being the result of inefficiency. This may lead to either an under- or overstatement of the level of inefficiency, and as a nonstochastic technique, there is no possible way in which probability statements of the shape and placement of this frontier can be made. There is a substantial freedom is given on the specification of inputs and outputs (the formulation of the production correspondence relating inputs to outputs). In cases where the usual axioms of production activity break down (i.e., profit maximization), the programming approach may offer useful insights into the efficiency of these types of industries. The piecewise linear production frontier formulated by DEA is generally more flexible in approximating the true production frontier than even the most flexible parametric functional form.

Assaf et. al. (2015) analyzed the frontier methods only taking into account DEA and SFA approaches. In contrast to Worthington (2004) came to an opinion that the method itself (DEA of SFA) does not seem to be an important factor in the efficiency results. For example, studies that used the nonparametric DEA on average do not report higher efficiency scores than studies that used the SF parametric approach.

On the contrary, there is evidence that the model specification seems to be more consistency about the impact of on the efficiency results (Assaf et. al. 2015). Studies with input-oriented models also seem to report lower efficiency scores than studies with output-oriented models (Assaf and Josiassen 2015).

Previously mentioned papers demonstrated only a comparison between assessments made by different approaches. Rosko et al. (2008) made an attempt to verify robustness of SFA in estimating cost inefficiency. They argues that the choice of cost function (of itself) has minimal impact on estimated mean inefficiency, estimates of relative inefficiency, and relative ranking based on inefficiency estimates. Moreover, the research confirmed the most frequently met in literature recommendations to use one-stage estimation as it shows more efficient results in estimations of the impact of correlate variables on inefficiency.

While a variety of frontier techniques exist, DEA and SFA are the most frequently applied approaches. Farrell (Farrell 1957) was the first to estimate productive efficiently as a distance from a BPF using linear programming methods. A significant breakthrough occurred when Charnes, Cooper, and Rhodes (Charnes, Cooper et al. 1978) generalized Farrell's single input/output measure to a multiple-input/multiple-output technique, which they termed DEA. Charnes, Cooper, Lewin, and Seifford (Charnes, Cooper et al. 1994) viewed the development of two-stage analysis as a significant advance in DEA-based research. Combining nonparametric and parametric methods, researchers in the early 1990s began to explore the factors that determine inefficiency.

The most recent literature review article reported that, as of mid-2006, 317 articles on frontier efficiency of healthcare organizations had been published. Of these, more than 200 used DEA and 57 used SFA. About 25 studies were classified as Malmquist-based (an extension of DEA) productivity studies (Hollingsworth 2008).

The first SFA study of a healthcare organization was published in 1989. Since then at least 27 other U.S studies of hospitals have been conducted(Mutter, Rosko et al. 2011).

Before analyzing the empirical papers dealing with DEA or SFA application for estimation efficiency of HCOs, it is worth mentioning that there are a variety of indicators that could be chosen for analysis. B. Hadji et al. (2014) summarized recently published articles and identified that more than 17 input indicators and 19 output indicators in 38 articles analyzed. With the purpose of generalization they were classified into three groups of inputs and two groups

of outputs. The input groups are hospital capacity (e. g. number of beds), staff resources (e. g. number of staff by type), and hospital expenses (e. g. labor, capital, and others). In outputs groups there were identified activity indicators and financial performance indicators.

In spite of significant amount of articles using frontier methods is published, there are still many questions about how to assess the efficiency and efficiency of what to assess. Out of 19 analyzed articles, only one uses SFA in order to estimate hospital efficiency (Rosko and Mutter 2014). However, the efficiency estimated is not one of the whole HCO, but only a certificate-of-need regulation as a tool for promotion hospital efficiency by reducing duplication of services, which has shown that hospitals in USA with certificate-of-need regulations for acute care beds are more cost-efficient than hospitals located in other states

Among the rest 18 papers that were analyzed in this study, there can be identified three groups. First, that assessed the efficiency of the healthcare systems (Benneyan, Ceyhan et al. 2007, Asandului and Fătulescu 2013, Falavigna, Ippoliti et al. 2013, Rabar 2014).

Second, that assessed efficiencies of HCOs (Stanford 2004, Valdmanis, Rosko et al. 2008, Bernet, Moises et al. 2011, Ferreira, Marques et al. 2013, Hajduová, Lacko et al. 2014, VanderWielen and Ozcan 2014, Alonso, Clifton et al. 2015).

Third, that analyzed the efficiencies of separate department or efficiency of treatment patients with particular illness (Lai, Huang et al. 2011, Liu 2012, Testi, Fareed et al. 2013).

The common feature of most of the papers of all three groups is that they provides a ranking of health systems of HCOs in terms of their efficiencies(L. Asandului 2014; A.Z. Hajduova et al. 2014; C. Ferreira 2013; H.L. Siping, 2014 T.R. Jat, 2013; J.M. Alonso et al. 2015; T.V. Ramanathan et al. 2003; R.E. Stanford 2004; A. Testi et al. 2013; M.-C. Lai et al. 2011; X Liu 2012).

However, several authors did not restricted themselves to just ranking, but, for example, G. Falavigna, (2013) as the result of the research not only proposes a ranking of Italian hospitals, but suggests a new model which accounts for more aspects of the healthcare industry in comparison to previous research as well as underlines the need for rebalancing the various administrative levels of hospitals.

D. Rabar (2014) have assessed evaluation of Croatia's regional hospital efficiency and apart from demonstrating great disparities among counties in Croatia, she develops guidelines for implementing necessary improvements to achieve efficiency.

One of the less recent studies, but still valuable was done by J. Benneyan et al. in 2007. Elaborated ranking of healthcare systems was compared with the data from World health organization (WHO), and a weak correlation was revealed.

While assessing the efficiency of HCOs, the authors tends to narrow the subject of the research. So, P.M. Bernet et al. (2001) analyzed a so-called social efficiency, understanding as one of the most important measures an accessibility of HCO measured by patient's travel distance. However, the hypotheses about difference efficiency assessment when including travel distance in total resource use was rejected and only one hypothesis that claims the hospital ownership form (for-profit, not-for-profit (NFP), and public hospitals) to moderate the relationship between their technical efficiency and patient travel distances was accepted.

The ownership form was also studied by V.G. Valdmanis (2008), where an evidence that that public hospitals were more inefficient on four measures of inefficiency (overall, technical, scale, and quality congestion). NFP hospitals were the next most inefficient category, although there was a little difference between public and NFP hospitals. For-profit hospitals performed best, on average (V.G. Valdmanis, 2008).

The third group of papers deals with concrete profiles of illnesses, types of doctors or a successfulness of a recently embedded system. A. Testi (2013) assessed physician performance for diabetes. The study identified best practices both in terms of efficiency and effectiveness and efficiency in this research is understood as a basic DEA input-output model, while effectiveness was treated as patient care adherence to the prescribed guideline (in other words, the ability of the physician to follow an evidence-based program along the clinical

pathway for the care of patients with diabetes, rather than as a judgment about the final health status of the patients). As several previous studies, A. Testi (2013) apart from doing ranking comes to conclusion that performance should not be limited to efficiency, but should encompass clinical effectiveness.

One more article assessing the efficiency of particular method of diagnostics was published recently. X. Liu (2012) calculated efficiency of 65 positron-emission tomography (PET) facilities providing cancer screening in Japan. Interestingly, that on average it decreased from 2004 to 2006, probably, because reduced average number of cancer screening clients per facility. These contrasts with the upward trend in the number of PET facilities, which suggests that excessive competition may have a negative effect.

The key points of the articles that were discussed in this section can be found in appendix.

The gap: what is performance in healthcare and how to measure it?

Olivier Serrat (2010) emphasizes the problem of definition of performance. The definition he suggests states that performance indicators are numerical measure of the degree to which an objective is being achieved. In (Serrat 2010) performance is defined as an observable change or event that provides evidence that something has happened, either with an immediate effect occurred or a long-term process observed. Moreover, it is stressed that it has several dimensions: relevance, efficiency, effectiveness, sustainability, and impact. Thus, performance is multidimensional and its measurement should rely on a basket of interrelated benchmarks.

There are quite a number of papers discussing what performance is and how it should be dimensionalized. Based on a review of the entrepreneurship literature, Murphy et al. (Murphy, Trailer et al. 1996) identified four main performance dimensions: efficiency (e.g., return on equity (ROE)), growth (e.g., sales growth), profitability (e.g., net income), and size (e.g., net sales). Combs et al. (Combs, Crook et al. 2005) propose an organizational performance framework with three dimensions: accounting returns, stock market performance, and growth. Hamman et al. (Hamman, Schiemann et al. 2013) allocate four dimensions of organizational performance: profitability, liquidity, stock market performance, and growth. Moreover, in this study was analyzed 9 articles that tried to classify the term “organizational performance” (it should be noted that according to Hamman there was only 9 research dedicated to this topic).

According to Serrat (2010) each performance measurement should have a purpose from the list: to evaluate, control, budget, motivate, promote, celebrate, learn, and improve. Obviously there is no measure that would fit all of the purposes simultaneously. Neely (1999) rises similar question asking of how to decide which measures to adopt while developing a performance measurement system taking into account different dimensions, organization types, strategies, and other factors.

As mentioned above efficiency might be treated as one of the performance dimensions (Murhy et al. 1996). In management and economics literature three types of efficiency are widely recognized: technical, allocative, and productive efficiency(Worthington 2004).

Technical efficiency implies the maximum possible output from a given set of inputs. In the context of HCO, technical efficiency refers to the relationship between the resources used and an outcome of medical care. This outcome can be defined in terms of intermediate outputs (number of patients treated, patient days, waiting time, etc.) or a final health outcome (lower mortality rates, longer life expectancy, etc.).

Allocative efficiency reflects the ability of an organization to use the inputs in optimal (cost minimizing) proportions given their prices and the available production technology. In other words, allocative efficiency deals with choosing between the different technically efficient combinations of inputs used to produce the maximum possible outputs.

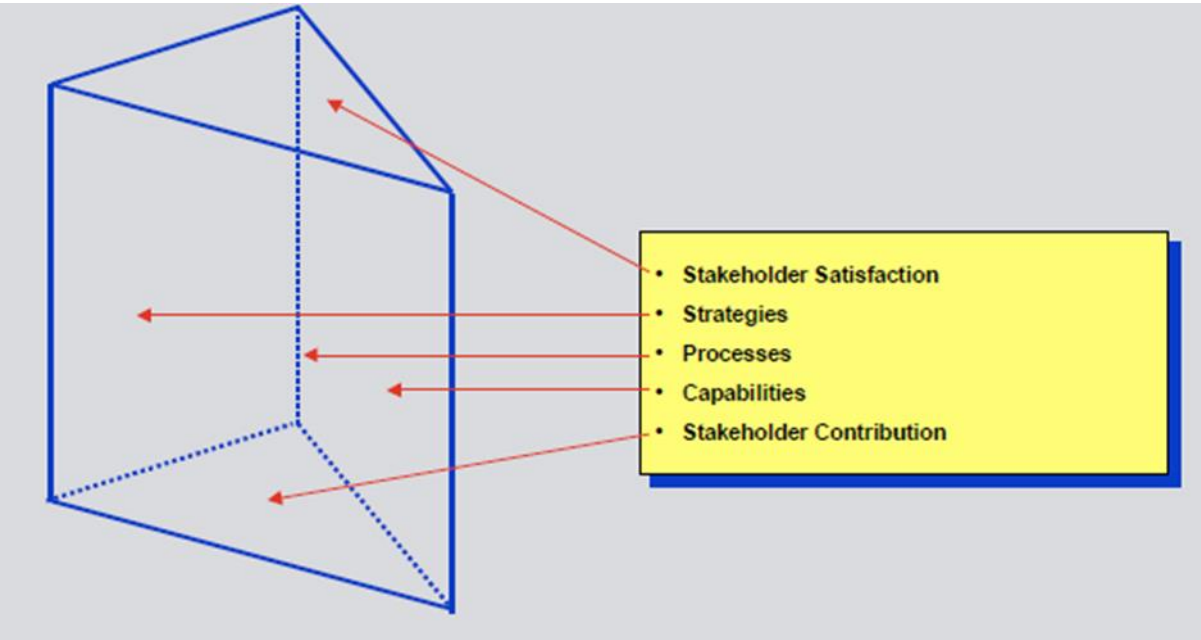
Productive efficiency summarizes technical and allocative efficiencies. The degree of productive efficiency is also known as total economic efficiency.

According to introduced literature review it can be inferred, that assessing performance of HCO most scholars understand in their own way in order to be consistent with the goals of particular research. However, there are several fundamental research that tries to define what should be understood beyond the term "performance". The most frequent treatment of performance is technical efficiency, which is rather limited definition.

Neely and Adams (2002) suggest a broader treatment of performance as compared to mentioned above. Their "performance prism" not only has five dimensions (stakeholder satisfaction, strategies, processes, capabilities, stakeholder contribution), but also provides a spatial perception of the term (Neely and Adams 2002).

Their solution to the problem is a three dimensional model that is called the Performance Prism. As shown on the figure 1, the Performance Prism has five facets – the top and bottom facets are Stakeholder Satisfaction and Stakeholder Contribution respectively. The three facets are Strategies, Processes, and Capabilities.

Figure 1. The Performance Prism framework (Neely and Adams 2002)



Those organizations aspiring to be successful in the long term within today's environment have an exceptionally clear picture of who their key stakeholders are and what they want. They have defined what strategies they will pursue to ensure that value is delivered to these stakeholders. They understand what processes the enterprise requires if these strategies are to be delivered and they have defined what capabilities they need to execute these processes. The most sophisticated of them have also thought carefully about what it is that the organization wants from its stakeholders – employee loyalty, customer profitability, long term investments, etc. In essence they have a clear business model and an explicit understanding of what constitutes and drives good performance. This framework can be helpful for developing the measure of performance for HCO.

While many efforts are underway to analyze and report mainly the efficiency of HCOs, there is great interest in further research to the level of organizational performance. Health system performance has a number of aspects – including population health, health outcomes from treatment, clinical quality and the appropriateness of care, responsiveness, equity and productivity – and progress is varied in the development of performance measures and data collection techniques for these different aspects. Considerable progress has been made as for

now, but overall the research is at an early stage of development (Smith, Mossialos et al. 2008).

It is important to remember, that HCO has its own specifics that make assessment of the performance more complex. The purpose of each public HCO is to provide medical aid for citizens. In Russian Federation, there are two conditions under which the aid is provided.

First is the obligatory medical insurance (OMI) system. Each citizen is of St. Petersburg has medical insurance according to legislation (Federal law of 29.11.2010 № 326-ФЗ "On obligatory medical insurance in Russian Federation"). When delivering medical aid to a citizen, HCO receives compensation of costs by medical insurance companies, which, in order, obtain the money from Territorial OMI fund of St. Petersburg.

Second is commercial medical aid, when patients first pay themselves for the aid in cash desk and then get their health service. On one hand, public HCO is a budgetary organization with public financing, but on the other hand, it is a profit making organization. Moreover, because of the term "budgetary", according to Russian legislation, it cannot show net income from its activities. Thus, there are two dimensions of purposes, both of which cannot be treated through typical performance indicators.

The resources have also their own specifics with respect to HCO. One of the most important resources is medical personnel and intellectual capital. Total number and qualification of doctors and nurses has a crucial importance when one talks about saving patients lives. Medical and engineer equipment, hospital premises, availability of drugs, etc., consist a material infrastructure, the requirements to which become higher continually. Patient also can be treated as resources for HCO, as well as time spent of their treatment.

The process of treatment has high uncertainties of outcome provided by treatment. It depends on patients age, type, severity, and stage of illness, individual characteristics and tolerance of an organism to medicaments, etc.

That is why the output cannot be treated as one-dimensional indicator. At least it has a dimension of result of aid received by patient and dimension of volume of treatment provided. As a result of medical aid received by patient such measures can be used as fact of total recovery from illness, number of life-years after treatment, etc. Volume of treatment provided traditionally measured as number of treated patients, death rates, number of days of treatment, number of diagnostic procedures etc.

Thus, it is obvious that economic efficiency measures obviously do not cover the full range of performance dimensions of HCO, hence, they are not sufficient for assessing performance and efficiency of HCO. However, nowadays there is no possibility to cover the full range of performance dimensions because of lack useful statistical information that is collected by City Government. For example, there are several forms of approved by Federal Statistical Agency in line with which the data is collected: № 10, № 14-Ф, № 14-МЕД (ОМС), №62, and others. Form № 10 and № 14-Ф (ОМС) requires to fill in only indicators characterizing cash flows of HCO by their sources and direction of their usage. The form № 14-МЕД (ОМС) is more fundamental. Apart from item-by-item cash flows it provides the data about medical profiles treated in the HCO, number of beds by profile, and volumes of medical aid delivered in terms of number of patients treated with denoted profile. The form № 62 is known to be one of the most informative. It contains the following information: cash flows classified by following types of inflows and outflows: conditions of aid delivered (inpatient, outpatient), profiles of aid delivered, degree of urgency of aid delivered; cash flows classified by accounting items; cash flows from commercial medical activities; and number of personnel classified by its qualification.

As it is follows from previous paragraph, the existing reports contain too little information in order to measure enough dimensions to get more real picture of performance and efficiency of HCO. Of course, the HCO themselves have the required data, for example, about medical infrastructure, various characteristics of treated patients, both volume and result dimensions of outcome, etc. However, such information is not collected and analyzed by City

Government, which makes almost impossible task of assessing the performance and efficiency on the level of all city HCOs.

Currently in St. Petersburg exists regulation of the Health Committee of 05.11.2013 № 439-p "On approval of the indicators and criteria for assessing the efficiency of the public health institutions of St. Petersburg, their managers and employees".

It should be noted that this instruction offers several dozen indicators that reflect some aspects of the performance of HCOs. For each criterion the assignment of points for the achievement of the targets is provided. Such indicators as fulfillment of government order (in %), achievement of rates of wages (in %), number of complaints from patients, number of aftereffects, death rate classified by causes, number of wrong diagnosis made, staffing of HCO classified by doctors, medium and lower-level medical personnel, qualification of medical personnel, quality medical aid delivered to patients, number of participation of HCO in scientific events, standard and time compliance of medical aid provided. The regulation proposes to allocate between HCOs the amount of money proportional to their so-called performance, which is computed as sum of scores for each of the indicators. However, there are several weak points. The list of assessed indicators is not exhaustive, because such important information is missing as material infrastructure, time spent on each patient, severity of patients, intensiveness of treatment and other aspects. Moreover, the method of assigning of scores is rather unequal. For example, if an HCO has no compliances, it receives 3 scores, but if there is 1 or more – 0 scores; if there is at least 1 aftereffect in an HCO, it receives 0 score, and only if it has no aftereffects at all it would receive 3 scores. It should be noted, that by tens of years of statistical monitoring of activities of HCOs worldwide, there is a difference between outcomes of emergent hospitals and regular ones. Obviously, emergent hospitals (HCO where most of the patients are delivered by emergency) have bigger rates of deaths and aftereffects. For example, in 2013 there were 4539 planned hospitalizations of noncomlicated hernias, 4379 of which were operated. Death rate was 0.02% (1 patient). However, from 1526 patients hospitalized emergently with strangulated hernia the death rate was 4.3% (65 patients). In other words, the situation of emergency under this nosological form is characterized by lethality of 65 times more than of planned form(Яблонский, Кабушка et al. 2015).

Similar differences are expected because of different profile of medical care delivered to patients in different hospitals.

Furthermore, there are some contradictions in creating incentives to improve the efficiency of health services. One of the incentives is rewarding executives and (or) their deputies in case of achieving target figures or setting penalties in the opposite case. At the same time, there is a regulation of the Government of Russian Federation № 571, where the target size of the average wage from all sources of financing based on one individual (with a tendency to increase by 10-20% annually) is approved. Thus, the imposition of fines may result in a difference to target size of wages, that is, the failure of the federal legislation.

Thus, the system of assessing the efficiency and performance of HCOs needs refinement and elaboration because of its inconsistency. In support of this argument, the results of the survey that was conducted by Ministry of health of the Russian Federation, are provided here. According the survey, only 21% of medical statistical personnel and 36.4% of top-management personnel tend to trust to the official statistics (Яблонский, Кабушка et al. 2015).

However, the proper system of monitoring HCO performance (as basis for measuring performance and efficiency) is rather difficult to implement. In order to do that, first of all, one should understand what a healthcare system is. Healthcare systems are integrated combinations of several activities intended to promote, restore, and maintain health. The evaluation of the efficiency and weighting by which multiple types of resources are consumed to produce multiple types of outputs to accomplish these objectives frequently is largely subjective (Benneyan, Ceyhan et al. 2007)**.**

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Appendix

Overview of articles dealing with efficiency of healthcare organizations

	Author (s), year	Title	Research object	Research subject	Method (s)
Methodological papers (methods)					
1	A. George Assaf, Alexander Josiassen, 2015	Frontier Analysis: A State-of-the-Art Review and Meta-Analysis	Research studies in tourism industry based on frontier analysis. Research, using frontier analysis methods in tourism industry	Important research directions using frontier analysis in tourism industry	Meta-analysis
2	Andrew C. Worthington 2004	Frontier Efficiency Measurement in Healthcare: A Review of Empirical Techniques and Selected Applications	Studies that analyze and (or) measure efficiency for healthcare organizations	Types of efficiency measured; Interpretations of the results of efficiency measurement	Meta-analysis
3	Michael D. Rosko Ryan L. Mutter 2008	Stochastic Frontier Analysis of Hospital Inefficiency A Review of Empirical Issues and an Assessment of Robustness	Studies of hospital inefficiency (20)	Robustness of SFA in estimating cost inefficiency	SFA
4	Michael D. Rosko Ryan L. Mutter William H. Greene Paul W. Wilson 2011	Translating Frontiers Into Practice: Taking the Next Steps Toward Improving Hospital Efficiency	Methods of frontier analysis (DEA and SFA) for hospitals	Application of methods of frontier analysis for hospitals	Analysis of literature
5	Andy Neely Chris Adams 2002	Perspectives on performance	The term “performance”	Evolution of concept of performance	Literature review, interviews
6	Andy Neely Mike Bourne Mike Kennerley 2000	Performance measurement system design: developing and testing a process-based approach	Performance measurement systems	Structured methodology for design for performance measurement systems	

Methodological papers (objects of research)					
1	Brahim Hadji, Rodolphe Meyer, Samir Melikeche, Sylvie Escalon, Patrice Degoulet 2014	Assessing relationships between hospital resources and activities: a systematic review	Hospitals	Beds, resources, activity, and financial outcome of the hospitals	Meta-analysis (38 articles)
Empirical papers					
1	Patrick M. Bernet, James Moises, Vivian Grace Valdmanis, 2011	Social Efficiency of Hospital Care Delivery: Frontier Analysis From the Consumer's Perspective	Hospitals	Efficiency and access for hospitals	DEA
2	Michael D. Rosko Ryan L. Mutter 2014	The association of Hospital Cost-Inefficiency With Certificate-of-Need Regulation	Hospitals	Certificate-of-need regulation as a tool for promotion hospital efficiency by reducing duplication of services	SFA
3	Lynn M. VandeWielen Yasar A. Ozcan 2015	An assessment of the healthcare safety net: performance evaluation of free clinics	Free clinics	Performance of Free clinics	DEA (Output-oriented, VRS) Inputs: Private funding, Government funding, miscellaneous funding; Outputs: general medical visits, specialty visits, prescriptions, other visits
4	Angela Testi, Naleef Fareed, Yasar A. Ozcan, Elena Tanfani 2013	Assessment of physician performance for diabetes: a bias-corrected data envelopment analysis model	Family physicians	Performance of family physicians	DEA (VRS); evaluating "efficiency performance";
5	James Benneyan, Mehmet Erkan Ceyhan Aysun Sunnetci 2007	Data envelopment analysis of national healthcare systems and their relative efficiencies	National healthcare systems	Relative efficiencies of national healthcare systems	DEA (CRS-O, CRS-I, VRS-O, VRS-I); (modified DEA methods) Data element or surrogate measures: Care and Outcomes: Healthy life expectancy (O); Adult mortality rate (O); Infant mortality (O); Morbidity surrogate measure (TB rate) (O); Cost & Resources: Per capita total expenditure (I); Doctors and nurses per 1000 capita (I); Hospital

					beds per 1000 (I); Equity; Weighted combination of urban-to-rural under 5 yr mortality rate, upper-to-lower wealth quartile,and none-to-high education mother ratios (O). Prevention: Surrogate measure (immunization rate) (I); Safety: Incidence rate of medical misadventure (O) Demographics: Median age (I)
6	Mei-Chi Lai, Hao-Chen Huang, Wei-Kang Wang 2011	Designing a knowledge-based system for benchmarking: a DEA approach	Benchmarking	Knowledge-based system	DEA (CCR-I, BCC-I)
7	Danijela Rabar 2014	Evaluation of Croatia's regional hospital efficiency: an application of DEA	Croatia's counties healthcare systems	Efficiency of Croatia's counties healthcare systems based on hospital's performance	DEA (BCC-I)
8	Greta Falavigna, Roberto Ippoliti, Alessandro Manello 2013	Hospital organization and performance: a directional distance function approach	Italian healthcare system	Efficiency of Italian hospitals	Directional distance function. A specification of standard DEA model is created. The Directional Distance Function (DDF) is a non-parametric and deterministic methodology, more flexible and able to consider good and bad outputs (output approach). Considers efficient each hospital which is able to maximize the production of medical treatments while complying at the same time, with budget constraints
9	Vivian G. Valdmanis, Michael D. Rosko, Ryan L. Mutter 2008	Hospital quality, efficiency, and input slack differentials	Urban US hospitals in 34 states operating in 2004	Quality and efficiency of hospitals	DEA (congestion analysis, CRS, VRS, scale efficiency).
10	Zuzana Hajduova, Roman Lacko, Stela Beslerova 2014	Measurement of technical efficiency in selected university hospital	Slovak university hospitals in terms of departments	Technical efficiency of Slovak university hospitals	DEA (BCC-I, CCR-I)
11	Laura Asandului, Puiu	Measuring the efficiency of	EU health systems	Efficiency of EU health	DEA (CCR-I)

	Fatulescu 2014	EU health systems using DEA		systems	
12	Arianna De Nicola, Simone Gitto, Paolo Mancuso, Vivian Valdmanis 2013	Healthcare reform in Italy: an analysis of efficiency based on nonparametric methods	Healthcare systems of 101 Italy's provinces	Efficiency of healthcare systems of 101 Italy's provinces	Two-stage DEA (VRS-O) Three inputs (physicians, nurses and number of beds); two outputs (number of total patients and case mix index (to account for the severity of the illness treated by the healthcare providers))
13	Claudia Ferreira, Rui C. Marques, Paulo Nicola 2013	On evaluating health centers groups in Lisbon and Tagus Valley: efficiency, equity, and quality	Health centers	Efficiency of health centers	DEA (CRS, VRS; input, output, not oriented models)
14	Hao Li, Siping Dong, Tingfang Liu 2014	Relative efficiency and productivity: a preliminary exploration of public hospitals in Beijing, China	Public hospitals in Beijing, China	Relative efficiency of public hospitals in Beijing, China	DEA, Malmquist index
15	Tej Ram Jat, Miguel San Sebastian 2013	Technical efficiency of public district hospitals in Madhya Pradesh, India: a data envelopment analysis	Public district hospitals (emphasis on maternal healthcare services)	Efficiency of public district hospitals	DEA (VRS-I) The input variables for each district hospital were: (1) number of doctors (specialists and primary care physicians); (2) number of nurses; and (3) number of beds. The number of beds variable was included as a proxy indicator for capital inputs. The output variables were: (1) number of women with three completed antenatal checkups; (2) number of deliveries; (3) number of cesarean-section deliveries; (4) number of women receiving post-natal care within 48 hours of delivery (PNCs); (5) number of medical terminations of pregnancy (MTPs); (6) number of male and female sterilizations; (7) number of inpatient (IPD) admissions; and (8) number of outpatient (OPD) consultations.
16	Xuanxiu Liu 2012	The efficiency of healthcare facilities providing PET cancer screening in Japan	PET facilities	Efficiency of PET facilities	DEA, multivariate regression analysis
17	Jose M. Alonso, Judith Clifton, Daniel	The impact of new public management on efficiency: an	Hospitals in Madrid	Efficiency of hospitals in Madrid	DEA (bootstrapped, VRS-I) As inputs, we have used the number of beds, num-

	Diaz-Fuentes 2015	analysis of Madrid's hospitals			ber of full-time employed physicians and the number of full-time nursing staff. As outputs, we have considered the number of discharges and the number of outpatient visits.
18	Thekke V. Ramanathan, Koni Suresh Chandra, Wilson M. Thupeng 2003	A comparison of the technical efficiencies of health districts and hospitals in Botswana	Health districts and hospitals in Botswana	Relative efficiency of health districts and hospitals in Botswana	DEA. Inputs: Hospitals in the districts; Clinics in the districts; health posts in the hospitals, beds, doctors, nurses; health staff. Outputs: Outpatients by 11 diseases groups (separate output for each group); outpatients in all groups; new births discharged alive; inpatients discharged alive; patient days
19	Robert E. Stanford 2004	A frontier analysis approach for benchmarking hospital performance in the treatment of acute myocardial infarction	107 state medicare hospitals	Benchmarking of treatment of acute myocardial infarction (heart attack) in Alabama, Connecticut, Iowa, and Wisconsin	DEA (CCR-. Cross-efficiency, peer-efficiency.