INTRODUCTION

At present, variability is the rule when looking at issues related to the provision of health care at regional, national or international level, and this situation calls for comparisons to be made in order to identify best practices; in this context of the existence of this wide variability (in terms of definition, measurement, costs, results etc) [1], the comparisons are much more difficult achieved. On the one hand, developments in health organizations and health systems, together with scientific and technological advances in the health sector, as well as the adaptation and implementation to varying degrees of these achievements led to the obtaining variable results at health system level. On the other hand, the capacity to finance national healthcare systems is different at country level, depending largely on government policy and financial strength at a given point in time. Permanent pressures stemming from technological advances, the development of new and more effective (but often more expensive) technologies have major repercussions, and these are particularly exerted on governments that have to keep these high costs behind, the phenomenon being called cost contention.

In the same sense as this trend, the measures for these problems (that are guided by the need to implement innovative and efficient new solutions and technologies) seem to differ quite widely. While some countries focus on decreasing health care costs, others are trying to improve health results of medical activity.

Performing well enough to ensure high-quality health care for all citizens is no longer the only standard to be achieved, but also requires an efficient and effective organization and implementation of effective interventions that allows us to obtain the quality required to provide optimal health services and to minimize the waste in the medical sector.

In practice, performance must be doubled by efficiency, and the analysis of the two terms (costs and outcomes) should frame the domain of intervention and identify scientific evidence to support healthcare policies.

Ensuring high-performance health care is the main goal of any society. Against this background, political ability and will are decisive factors alongside the development of rigorous science-based health policies.

The resource and outcome indicators should be analyzed concurrently in the specific context, respectively in an economic assessment that is the starting point for identifying or highlighting possible interventional measures on the two parameters analyzed, namely costs and results. The European pattern noted in this paper highlights the fact that the allocation of very much money for health is an example of efficiency only if the growth is progressively so it is doubled by a technical efficiency (the emphasis is on increasing the result measured by outcome indicators, on innovative organizational and technical solutions with impact on the individual or population’s health; for this case where the saved lives attributable to medical interventions are calculated, on innovative solutions that lead to the saving of human lives). A domain (upper threshold and lower threshold) of efficacy, as well as of effectiveness should be established. In other words, regardless of the national context, efficiency gains can always be achieved by focusing on increasing the results and impact on health status while costs are minimized.

The multitude of the determinants of the disease leads to a real impotence in the prevention and treatment of diseases. Any joint effort of society can not definitively eliminate the phenomenon of disease.

We can identify innovative solutions that can counteract the onset of the disease (primary prevention) or reduce the consequences of the onset of the disease (secondary prevention, curative services, rehabilitation services), and these solutions to be included in the integrated policies on the organization and functioning of the system on healthy principles such as quality and efficiency.

Key words: efficiency, amenable mortality, saved lives attributed to medical interventions, Romania

BACKGROUND

The performance of healthcare systems has been and is still a frequent concern for researchers, but also for decision-makers’, and attempts to assess the effectiveness of healthcare systems have progressed steadily over time.

Measuring the phenomenon of "avoidance" in the medical field (avoidable risk, avoidable hospitalization, avoidable mortality etc.) is currently a fairly widely used approach materialized in particular through numerous comparative studies that seek to identify good practice models; it is aimed at identifying the best models that through their application can influence to a very large extent the...
occurrence and frequency of the studied phenomena, or even can led to obtaining positive, direct or indirect results. In this respect, one of the indicators commonly used in the last decade is 'avoidable mortality' that is an indicator that quantifies the causes of death and age groups for which effective and timely medical care should help to prevent death [2]. The indicator can be used for assessing health, but also for planning and assessing health services [3].

There are two components of avoidable mortality, namely preventable mortality and amenable mortality to medical interventions, and for each of these two types of causes of death there are separate lists of avoidable death causes established by groups of experts and specialists.

Thus, avoidable mortality and causes of death were divided according to the way of solving the existing diseases in:

- Amenable mortality (causes of death for diseases treatable by medical interventions and secondary prevention, such as infectious diseases including tuberculosis, hypertension, some malignant tumors);
- Preventable mortality (causes of death for preventable diseases through primary prevention and cross-sectoral health policies such as policies to reduce the use and consumption of tobacco, alcohol or drugs, road accident reduction policies (speed limitation, safety belts etc.)

Lately, at international and European levels, there is a strong concern to identify methods of comparing health systems by using economic assessments, where results are measured through outcome indicators such as: life expectancy, healthy life expectancy and amenable mortality rates. Some of these studies have also calculated the stochastic frontiers of efficiency, and the published results do not place Romania in the most efficient group, nor in the most inefficient group among the EU countries.

Thus, the Czech Republic, Lithuania and Slovakia have the lowest efficiency scores in most of the models used, and being followed by Hungary, Latvia, Poland and Estonia. In all models used, Belgium, Cyprus, Spain, France, Italy, Sweden and the Netherlands consistently record the highest efficiency scores [4].

**AIM.**

The main aim of this article is to present the results of the evaluating the effectiveness of medical interventions at health system level, using the estimation of the results of medical interventions by the indicator "mortality attributable to medical interventions/amenable mortality".

**METHOD**

To achieve the research objective set for this paper, we have proceeded to a cost-effectiveness analysis of medical interventions at the national health system level (based on Eurostat data). Compared to the assessment of the effectiveness of an intervention, locating the assessment at the health system level makes it much more difficult to calculate [4], appreciate or estimate the efficiency of a health system relative to another health system, given the multitude of dimensions/faces through which the two parameters (costs and results) can be calculated as well as the difficulty in obtaining the necessary data.

For both parameters (costs and results), accurate calculation of their value is difficult to achieve. As far as costs are concerned, they represent the equivalent in monetary units of resource consumption; the resources are represented by all the inputs necessary for the provision of health care, respectively the costs due to the organization, planning, coordination, management and control of entire medical activity.

Thus, for the cost analysis, all relevant costs, by category (capital, recurrent, direct, indirect, fixed, variable, health sector, other sectors), should be detailed and accounted for so that all relevant expenditure are accounted for by relevant consumption categories, and the cost of each consumed resource is calculated. A much simpler method could be the use of complex indicators to reflect as accurately as possible the amount of resources used and consumed. For this paper, the indicator "Health expenditure per capita, measured in PPP units" was used.

In terms of results, the difficulty of the analysis is even greater. The difficulty is given by the multiple dimensions of medical activity derived from the complexity of the concept of health (physical, emotional, social dimensions), as well as the degree of achievement and the way in which a certain result is obtained.

The provision of health services is carried out in the classic model of a process:

\[ \text{Inputs} \rightarrow \text{Process} \rightarrow \text{Outputs} \rightarrow \text{Outcomes} \]

where:

- Inputs = total entries (Euro, PPS, PPP per capita, etc.)
- Process = related activities;
- Outputs = intermediate results (interventions performed etc.)
- Outcomes = final results with impact on health status (saved lives, life years gained, etc.).

While measuring the outcomes of medical activity through output indicators may point to how a certain amount of resources has been consumed, indicators that measure the impact on health (outcome indicators) can better quantify the efficacy of medical activity as they can measure quite accurately the effect of medical interventions on the health status at the individual or population level.

Starting from the above-mentioned context, we can assume that mortality (the demographic phenomenon that refers to the frequency of deaths in a certain population), may be an output indicator of the entire health policy of a territory, with two essential conditions:

- given that mortality is a negative component of the
natural movement of the population (associated in this sense with a negative result of medical interventions rather than a positive outcome), the use of this indicator in an economic evaluation could be valid only to the extent that this indicator would allow to calculate/estimate the positive result of medical interventions (ie saved lives);

-given the multi-determinism of health (environment, human biology, behavior, health services) - see Denver model, it is essential to identify positive events attributable to medical/health care interventions (lives saved as a result of medical interventions/services) that in turn can be: preventive, curative or recovering.

In other words, it is necessary to quantify the contribution of healthcare to the state of health and to account for the lives saved as a result of the influence of health care that can be calculated as a difference between the number of amenable deaths (in the presence and absence of costs for health) based on a unitary model (eg model registered in EU Member States).

RESULTS
Health expenditure in Romania versus European Union member states
In Romania, over time, it appears that politicians have paid increasing attention to financing the healthcare system, materialized by increasing the share of health expenditure in total expenditure reaching in 2014 the value of 5.6 (according to the values in the set of development indicators compiled by the World Bank, on the basis of existing national statistics) - graph 1. Of course, the trend of growth is positively viewed among politicians, but not among analysts and researchers, and the question that arises (especially when looking at the results of the Romanian health sector) is whether this level is enough for the Romanian and European context respectively.

To the question "How much should a state invest in health?", it is very difficult to answer if we only analyze health expenditure without correlating it with the results obtained, and with the national context that includes the cultural factors along with the determinants of health, and these factors represent, in fact, the variable components at the state level.

The analysis of health expenditures in an international context places Romania on the last position. Thus, on an overview of the share of GDP allocated to health sector in other states, we can see that the level achieved in Romania is the lowest in the EU states (below 6%, almost twice as low as the one higher share in five European countries, 11-12% in France, the Netherlands, Belgium, Germany and the UK) [4].

Also, if we report the level of health expenditures per capita for health is allocated also in Romania (only 865 purchasing pwoer standards per capita (PPP)), which shows that in Romania, compared with Luxembourg (the highest level of the indicator: 4131 PPS per inhabitant), almost 5 times less money per person is allocated to health [4].

If we use PPP as the unit of measure for assessing the level of health expenditure at the individual level, the gap is again reduced (PPP Denmark/PPP Romania = 3/1).

But no matter how much we adjust the value of the indicator according to the parameters that influence the expenditure level (unit of measure, price, population number, etc.); the difference between these values remains very high and this finding requires a deep analysis on the money which should be allocated for health.

If we judge having in mind the principle that health costs and health is the most valuable asset, then the judgment is simple and a lot of money should be allocated.

But if we judge having in mind the principle of effectiveness then an economic assessment should be made having the role to identify levels of expenditure for which efficiency does not increase regardless of the additional amounts we can allocate, such as setting stochastic efficiency limits.

Regardless the type of healthcare system adopted at national level, the syntagma "health costs" can not be underestimated. If at individual level each citizen or patient feels differently the financial burden of illness or disease prevention depending on health value and financial capacity (the patient would pay however for health), instead at society level, where there are very high health expenditures that can be translated into financial burdens for governments and society.
(health should cost the system as long as it can deliver efficient and effective services meaning that the state should pay a minimum value for effective results).

A correct analysis of health expenditure should take into account the equivalence in monetary units of all resources consumed within a health system (both public and private allocated financial resources, all human resources, material resources, infrastructure, material endowment, utilities etc.).

**Healthcare system effectiveness in Romania versus European Union member states**

Given that the purpose of this paper is to use an economic assessment, which is a comparative analysis between different states, the indicator "Total Health Expenses in PPP" will be retained for cost analysis, while the "Saved Lives Atributable to Medical Interventions" (an indicator that can be calculated by using the value of Amenable Mortality Rate) will be used to assess the efficacy/outcomes.

In the field of public health there are numerous studies that have proven the importance and relevance of measuring the quality and performance of medical services by using the "mortality attributable to medical interventions/amenable mortality" as indicator; some of these studies show some limits, besides the positive benefits of using this indicator (including the higher effectiveness achieved for smaller AMRs) in measuring this indicator at the health system level [5].

Measuring the effectiveness of the healthcare system by using the Amenable Mortality Rate (AMR) as indicator places Romania on the fourth place in the ranking queue at the level of the EU member states; Romania (390 deaths attributed to medical interventions at 100000 inhabitants), followed in this ranking by countries such as Slovakia (390 deaths attributed to medical interventions at 100000 inhabitants), Latvia (420 deaths attributed to medical interventions at 100000 inhabitants), and Lithuania (460 deaths attributed to medical interventions at 100000 inhabitants).

This value is more than four times the value recorded in France (the only country with less than 100 deaths attributed to medical interventions at 100000 inhabitants), which indicates that a Romanian citizen has more than four times the probability to die (for the same causes of deaths for diseases treatable by medical interventions) due to the absence of or ineffective medical interventions in Romania in comparison with a citizen in France. In the top of the list France is followed by Estonia, the Netherlands, Belgium and Cyprus.

If we look at the profiles of the countries analyzed in terms of cost (in PPP per capita) and Amenable Mortality Rate, and considering the average values in all EU Member States as references, we can see four models among these countries (see Graph 2):

- countries that allocate level of PPP per capita below the EU average and have fewer deaths attributable to medical interventions (More Effective & Less Expensive) - CY, ES, PT.
- countries that allocate level of PPP per capita over the EU average and have more deaths attributable to medical interventions (FI, MK, SK)

**Graph 2. Total Health Expenditure (PPP per capita) and Amenable Mortality Rate (AMR)**

Data sources: online data code Eurostat (Healthcare expenditure hlth_sha11_hf and Amenable Mortality hlth_cd_apr)
Table 1. Data on healthcare systems effectiveness measured by PPP per capita and life saved by medical interventions

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>COSTS Health Expenditure per capita in PPP</th>
<th>Amenable Mortality (rate at 100000 inhabitants)</th>
<th>Deaths attributable (for costs = 0)</th>
<th>RESULTS Saved Lifes per 100000 loc. (attributable to medical interventions)</th>
<th>Average Cost-Effectiveness Ratio (ACER) PPP/SAVED LIFE</th>
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<tr>
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countries that allocate level of PPP per capita over the EU average and have fewer deaths attributable to medical interventions (More Effective & More Expensive) - FR, NL, LU BE, IT

countries that allocate level of PPP per capita below the EU average, and have more death less attributable to medical interventions (PL, EE, BG, HR, RO, LV, LT).

The rate of deaths attributed to medical interventions can not be very precise in appreciating the level of the achieved result guven that the death is the negative event and not the positive benefit of the medical interventions. But as the evolution of a disease does not always lead to death, the question that arises in the context of measuring the positive events of medical interventions (saved lives through medical interventions) is: how many deaths occur in the absence of medical interventions.

For this, we can draw a relationship between costs of healthcare system and attributable deaths, since there is a strong, indirect correlation between the two indicators (corr = -0.633) and statistically significant (p-value <0.5), which shows that the higher the AMR, the lower the PPP per capita is, or the more PPP per capita we allocate, the fewer attributable deaths are obtained.

Thus, the equations of the line expressing the relationship between the two variables (PPP per capita and AMR) can be modeled and calculated, the lines being linear, logarithmic, exponential or even logistic. To exemplify the use of AMR in the estimation of efficiency, in the present paper we used the linear model for which the values of the coefficient of determination (0.41) were very close to the other types of equations (0.42 and 0.44), suggesting that over 40% of total AMR variation is given by PPP variation.

According to the linear equation obtained (AMR = 4.272 - 0.001 PPP) we can approximate that for PPP = 0, an AMR value of 427.2 deaths attributable to 100000 inhabitants is obtained; this value will be the reference value used for the calculation of potentially lives saved through medical interventions for countries that entered in this model, assuming that there is no medical intervention in the absence of costs.

Therefore, we can turn the AMR indicator into a positive result by approximating "potentially saved lives" as the difference between deaths attributable to medical interventions in the absence of medical interventions (427.2 deaths for costs 0) and the cost of deaths attributable to medical interventions in the presence of costs: for Romania, the value is: Saved lives = 427.2 - 390 = 37.2 lives saved by medical interventions).

Values of the results measured by saved lives can be found in Table 1, ordered by the value of "Average Cost Effectiveness Ratio" that is the indicator showing the efficiency of the national model compared to that in another country (the lower the value of this indicator, the more effective in terms of lives saved through medical interventions the national model is).

The analysis shows that healthcare system effectiveness (measured by average cost per saved lives) is correlated with the value of the result in saved lives (strong correlation, indirect, corr = - 0.62, p-value <0.5) rather than with the value of cost in PPP (weak correlation, indirect, corr = -0.25, p-value <0.5).

However, this finding highlights the stronger influence of the potential increase in the outcome (saved lives) on the efficiency of the health system (average cost per life saved), versus the weaker influence of the increase in PPP per capita which is also evidenced by the data from table 1 where the countries which allocate the most PPP per capita are placed at the middle of the ranking depending on the value of efficiency, while the countries with the most saved lives are located on the first positions.

The example of Cyprus is quite eloquent in the sense that the highest average cost per saved life was achieved with no so substantial money allocation but with a high result, suggesting that the focus should not necessarily be on allocating as much money (allocative efficiency), but by implementing curative solutions that lead to the lives saving (technical efficiency). Denmark can represent an atypical case in which it can be noted that with much money allocation is obtained the same result as other countries with many positions above the top efficiency are obtained (eg Portugal allocating almost half of Denmark's PPP per capita, ie only 1748 PPPs; EL that only allocates 2032 PPPs, the UK allocates only 2430 PPPs, etc.).

These examples support the obtained value of 0.41 for the determination coefficient in our model, suggesting the existence of other factors (such as, for example, different levels of morbidity through the diseases considered in the AMR calculation) that could explain the AMR variability.

Countries in the ranking queue are countries that spend less for health, respectively below 2000 PPPs (BG, HU, RO, LV, LT) and have the worst results (around or under 100 lives saved at 100000 inhabitants). Romania, similar to Slovakia, manages to get 37 lives saved at 100000 inhabitants, but it achieves this result with far lesser costs that represent even half of costs in Slovakia (1.119 PPP vs. 2232 PPP), and being strictly in terms of saved lives twice as effective. For these CE European countries in the ranking queue of this top, including Romania, it is very likely that the evolution of healthcare systems in recent decades (with reconfigurations, restructurings, reforms during the transition period and the periods following this evolution) has left its mark on the organization, functioning and efficiency of healthcare systems.

**CONCLUSIONS**

The role of health policies and interventions is to ensure that high quality health care services are provided to population so that their outcome has the expected impact on the health status of individual and population level.

The development of these policies must be based on sound and valid evidence that must be analyzed and interpreted...
in the context of the specific place and time. Result indicators must also be interpreted in the context of allocated costs, and in the context of the effectiveness assessment that can support effective and efficient actions.

Regardless of the model used (cost-benefit or cost-effectiveness or cost-utility or cost minimization analysis, linear method used in this paper or logistic method with stochastic effectiveness limits used in other papers [6]), it is important to analyse the level of costs in the specific context of each country, as well as in the context of the overall results obtained.

The European model noted in this paper highlights the fact that the allocation of very much money for health is an example of efficiency only if the growth is progressively so it is doubled by an technical efficiency (the emphasis is on increasing the result measured by output indicators, on innovative organizational and technical solutions with impact on the individual or population's health; for this case where the saved lives attributable to medical interventions are calculated, on innovative solutions that lead to the saving of human lives. A domain (upper threshold and lower threshold) of efficacy, as well as of effectiveness should be established.

In other words, regardless of the national context, efficiency gains can always be achieved by focusing on increasing the results and impact on health status (outcomes) while costs are minimized.

The multitude of the determinants of the disease leads to a real incapacity in the prevention and treatment of diseases. Any joint effort of society can not definitively eliminate the phenomenon of disease.

We can identify innovative solutions that can counteract the onset of the disease (primary prevention) or reduce the consequences of the onset of the disease (secondary prevention, curative services, rehabilitation services), and these solutions to be included in the integrated policies on the organization and functioning of the system on healthy principles such as quality and efficiency.

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