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The Economic Analysis in Medicine – *"Friend or foe?"*

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Money has long been a taboo issue in medicine. There have been long discussions about the possible linkage between the economic analysis and the duty of saving lives. Traditionally, medical doctors have been reluctant to incorporate the economical issues into their universe. However, today we are living in a world where every action, medical or not, is evaluated according to its cost. It is important to understand that the economical analyses focus on the well being of the society as a whole. On the contrary, the medical doctor still focuses mainly on the well being of the individual patient. Cost-effectiveness analysis is a measure of the first, not of the latter. The role of the doctors is "to be the patient's advocate, to do what is possible for the patient before them, regardless of the value provided to society" [1].

In this editorial we try to define the role of the economical analysis in today's medicine and to describe its basic principles. ❑

THE ROLE OF THE COST ANALYSIS IN MEDICINE

One of the basic economic rules is that resources are limited relative to human needs. Medicine is no exception. The need for better and better medical expertise seems endless while the budget has a (too) close end. A hospital has a finite number of resources, either human or material. These resources have to be divided between alternative frequently competing uses. In some hospitals the question could often be as dramatic as that: "What should we do with the money provided this month, should we buy thrombolytic drugs or coronary stents?" The role of economic analysis is to offer the best compromise, yet scientific solution. ❑

WHAT ARE THE METHODS OF COST ANALYSIS?

The issue of how much the society can afford to pay for the medical act is dealt by cost analyses. In the last years important recommendations have been published regarding this type of analysis in medicine [2, 3]. In summary, the ***cost-effectiveness analysis*** measures the money spent for every life year gained by a medical act. A better but more complicated type of cost-effectiveness analysis, called ***cost-utility analysis*** measures the money spent for

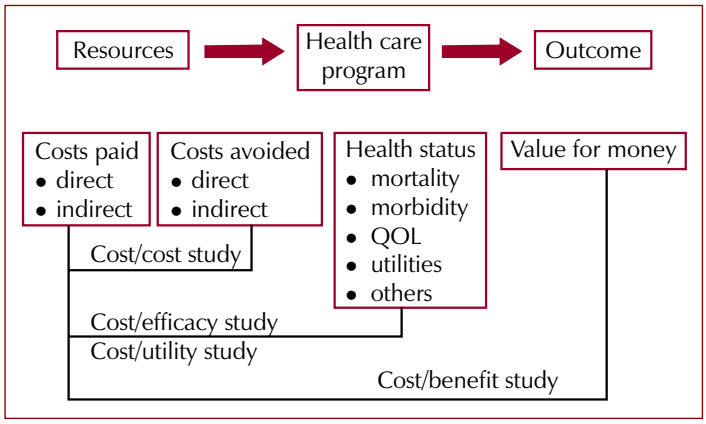

FIGURE 1. An integrated evaluation of health care costs. Modified from reference [4].

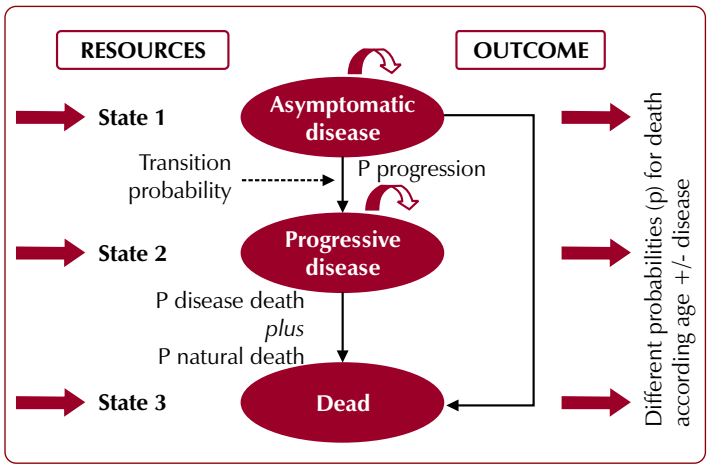

FIGURE 2. The Markov model. Modified from reference [5].

every standard quality year of life gained. It means that, for instance, a life-year gained with hemiplegia has a different evaluation compared to a life year with normal locomotion. If the benefit is expressed as monetary value for life gained as a whole, we are talking about ***cost-benefit analysis***.

However, the latter is seldom used in medical economics, since doctors are reluctant to annex a cost to a human life. Nevertheless, deontological problems do appear in any medical-economic analysis. For instance, has one year of life gained at the age of 8 has the same human value as one year of life gained at the age of 80? A type of analysis with less moral implication is the ***cost-minimization one***. In this analysis two alternative methods that lead to equivalent medical results are compared by price. The least expensive is considered a better option. ❑

FORMULA OF MEASUREMENT

Cost-effectiveness is expressed as the cost spent for the unit of benefit achieved. The simpler unit is the life-year gained (LYG) and the more complex, the quality-adjusted life-year gained (QALY).

The calculating formula is:

$$\text{Cost-effectiveness} = \frac{\text{Cost}_{\text{with the medical method}} - \text{Cost}_{\text{without the medical method}}}{\text{Unit of Benefit}_{\text{with the medical method}} - \text{Unit of Benefit}_{\text{without the medical method}}}$$

The units of measurement are money/LYG or money/QALY.

MODELS OF COST ANALYSIS

The calculation of costs is not always a simple issue. Every aspect has to be taken into account: direct costs (i.e. directly linked to the application of the health program: hospitalization, drugs, transport), indirect costs (e.g. production losses, substitutions: nursing at home, family care) and intangible costs (e.g. pain and human suffering). Therefore, the actual cost of the studied drug might be only a small part of the total final cost involved in the analysis (figure1) [4].

To calculate the total costs and the cost-effectiveness of a medical procedure several algorithms have been used. The most important of these algorithms is the Markov model [5]. We are not going to discuss it in detail. We will only mention that this model is constructed taking into account both type of costs and the probability of a given event / outcome of that patient (provided by previous statistics) Thus, the rate of development of each possible complication and death secondary to a particular disease is included in the model (figure 2). ❑

QUANTITATIVE AND QUALITATIVE LIMITS IN COST ANALYSIS

There are several limits that are used to say if a method is cost effective or not. The limits for United States are listed in table 1. The same criteria are used in both cost-effectiveness and cost-utility analysis.

	Cost/LYG or cost/QALY
Very cost effective	< 25.000 USD
Cost effective	25.000 – 50.000 USD
Relative cost-effective	50.000 – 100.000 USD
Cost ineffective	> 100.000 USD

TABLE 1. Usual limits used to assess the cost-effectiveness and cost-utility of a method

These figures were used to assess cost-effectiveness in the USA. Other countries with large financial health budgets adopted the same limits.

However, we have to be careful not to apply the same levels of cost-effectiveness into countries with smaller health care budgets. For example, if in the US, a cost spent per QALY for the prevention of sudden death with internal defibrillators might be relative cost-effective at a cost of about 70.000 USD/QALY [6] this is not true for a country like Romania, where the health care budget cannot support this cost. Therefore, the limits of cost-effectiveness mentioned above might be lower in poorer countries.

In table 2, we give some examples of cost-effectiveness of several therapeutic procedures frequently performed. One should be aware that some of these procedures, which can be considered routine in today's medical practice, do not have a low cost and are not very cost-effective. For instance, dialysis for end-stage renal disease is only relatively cost-effective with a cost per QALY gained of 50.000 to 100.000 USD (table 2). ❑

LIMITATIONS OF COST ANALYSES

One of the most important limitations of any cost-effectiveness analysis is that it is treating human life independently of any moral issue. Does a life have the same value as another life? Here again we must emphasis that the doctor is the patient's advocate and he must act in the individual patient's best interest. However, the doctor must be familiar with the cost-effectiveness analysis in order to think correctly about what medicine can do. He is the one that utilizes the limited resources available in his department in respect with the ever-growing medical needs.

The cost of innovation in medicine is not included in the normal cost-effectiveness analysis. This is a totally different problem. Normal cost-effectiveness analysis only deals with medications and procedures that have already been shown to be safe, effective and have been approved for use in clinical practice. All the enormous costs that are spent in the development of a drug or a procedure are not included into this type of cost-effectiveness analyses. These costs are credited and will be recovered by the pharmaceutical industry during the time frame when they have absolute monopoly over the production of a newly developed drug, but

Medical intervention	Cost-utility (cost/QALY)
Beta-blockers after myocardial infarction	< 3.600 USD (in high risk) to 20.200 USD (in low risk)
Hypertension medication	< 10.000 with lower therapy standard BP goals to > 100.000 USD with higher therapy standard BP goals and non-generic medications
Statins in secondary prevention	10.000 – 50.000 USD
Implantable cardioverter-defibrillator	30.000 – 85.000 USD
Left ventricular assist devices	500.000 – 1.400.000 USD
Dialysis for end-stage renal disease	50.000 – 100.000 USD
Mammography screening	10.000 – 25.000 USD
Colon-cancer screening	10.000 – 25.000 USD
Osteoporosis screening	10.000 – 25.000 USD

TABLE 2. Cost-effectiveness of different medical procedures. Adapted from references [7-9].

finally they are supported by the society. The price of that drug will be much higher than the future generic equivalent. Because of the large sum of money that is spent in innovation, the pharmaceutical industry is very reluctant to implement cost-effectiveness analysis into medical planning [10]. The Medicare insurance program in the USA does not take cost-effectiveness analysis into their decisions [7]. As of 2006, Medicare is covering the costs of any medical service available in the US, regardless of its cost [7]. This economical politics might have its price even in a rich country, such as the USA. In other countries, the cost-effectiveness analysis of a new drug represents "the forth hurdle" after the clinical trials, that a drug must overcome in order to be accepted on the market [10]. ❑

CONCLUSION

The cost-effectiveness analysis is an important tool that is used to find the optimal level of resources that should be used to solve a particular medical problem. It is important to remember than when one plans to allocate resources to a medical problem, the benefits have to be cost-effective. The cost-effectiveness analysis is a tool for the society, not for the medical doctor facing the individual patient. In the latter situation the doctor must take action according to the patient's best interest, regardless of the societal costs. Cost-effectiveness analysis serves the society as a whole.

There are several methods used in medical cost analysis. The cost-effectiveness analysis is defined as cost spent for a life year gained (cost/LYG) and the cost-utility analysis by the cost spent for a quality adjusted life year (QALY). The cost-benefit analysis, which is not usually utilized in medicine, is defined as the monetary value of a human life that is gained. The cost-minimization analysis consists in the comparison of prices of two alternative methods that lead to equivalent medical results.

In the face of limited resources, cost-effectiveness analysis is an essential tool and should be compulsory in the management of the health care system.

REFERENCES

1. **Hlatky MA, Mark DB** – Economics in cardiovascular disease. In: Braunwald's Heart Disease. A textbook of cardiovascular medicine, 7th edition, Elsevier-Saunders, Philadelphia, 2005, p20-26
2. **Russell LB, Gold MR, Siegel JE, Daniels N, Weinstein MC** – The role of cost-effectiveness analysis in health and medicine. *JAMA* 1996; 276:1172-1177
3. **Weinstein MC, Siegel JE, Gold MR, Kamlet MS, Russell LB** – Recommendations of the Panel on Cost-effectiveness in Health and Medicine. *JAMA* 1996; 276:1253-1258
4. **Torrance GW** – Measurement of health state utilities for economic appraisal. *J Health Econ.* 1986; 1:1-30.
5. **Briggs A, Sculpher M** – An introduction to Markov modelling for economic evaluation. *Pharmacoeconomics.* 1998; 4:397-409
6. **Sanders GD, Hlatky MA, Owens DK** – Cost-effectiveness of implantable cardioverter – defibrillators. *N Engl J Med* 2005; 353:1471-80
7. **Neumann PJ, Rosen AB, Weistein MC** – Medicare and cost-effectiveness analysis. *N Engl J Med* 2005; 353:1516-1522
8. **Goldenberg Arnold RJ, Kaniecki DJ** – Health economic considerations in cardiovascular drug utilization. In: Cardiovascular Pharmacotherapeutics, 2nd edition, McGraw-Hill, New York, 2003, p43-55
9. **Hlatky MA** – Understanding concepts related to health economics. In: Evidence Based Cardiology, 2nd edition, *BMJ* Books, London, 2003, p46-55
10. **Taylor RS, Drummond MF, Salkeld G, Sullivan SD** – Inclusion of cost-effectiveness in licensing requirements of new drugs: the fourth hurdle. *BMJ* 2004; 329:972-975