

# Effect of Patient Satisfaction and Medical Ethics on the Performance of Health care System

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## **Abstract**

*This paper presents the health system in Romania, focussing on the "actors" running it as well as on the fundamental objectives and complex analyses in terms of their reaction regarding patients, performance and position of each system on the health care market. The present research identified a public health care system based on inequities in the distribution of financial and human resources between institutions, regions, rural and urban areas and of health care delivery. Inequalities were also identified in the way patients' health needs are met. In this context a mathematical model was developed, which can help any institution increase the quality of its services and achieve performance. The main precondition required was that each institution should focus not on external financial resources but on the internal ones as well as on an increase in material base investment and on identifying ethical values that lead to patient satisfaction, i.e. the application of ethical principles in the proportion corresponding to the model. To conclude ethical principles in health care must be promoted since only due to these principles people will benefit from patient-centred care, will be provided respectful and responsive health care and above all will actually benefit from their right to health care.*

**Keywords:** *patient satisfaction, medical ethics, health system, mathematical modelling*

**JEL classification:** I11, I12

## **1. Medical Ethics Impact on Healthcare System**

The healthcare system creates its own image through the core values it promotes as well as through the ethical principles it adopts and implements. In this respect, we are speaking especially about equity as a concept that is closely related to the individual's basic rights to health care and accepting it as a bedrock principle of medical ethics – which is implemented and enforced by each and every active member of this system.

World Health Organization shows that there are interdependent relationships between promoting and protecting human rights to healthcare and promoting and enforcing human rights. Breaking the human rights to healthcare can impair the other rights such as the right to education or work or vice versa. The interference can be visible especially in the context of poverty. For poor people,

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health is the only asset on which they can rely for the other social and economic rights, as well as their right to work or education. Physical or mental health enables adults to perform a remunerated activity or children to learn (Piccolo et. al., 1996).

On the other hand, issues related to quality, equity and accessibility of medical services influence in their turn the efficient problem-solving of the population.

Access to medical care is determined by the convergence between supply and demand for this type of services, disparities regarding healthcare access are mainly due to four reasons: ethnical or racial, economic, including here the direct costs undergo by the population (co-payments, costs related to treatment and in-hospital treatment) as well indirect costs such as fares, waiting time, improper placement of healthcare facilities, uneven quality of services of the same type<sup>3</sup>.

Therefore an organization, the health care system respectively can create a favourable image by implementing and enforcing the health right of population and also by equally enforcing the other principles of medical ethics (Holm, 1995).

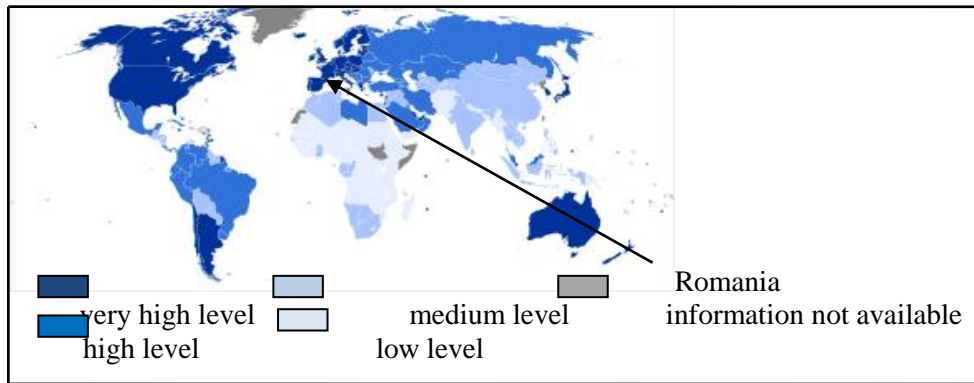
In contrast, inequities/inequalities such as discrimination on various grounds entail a negative image which is difficult to put up with and tolerate by a modern society that wishes to be treated equitably or as specialists put it, which leads in an incredible manner to the failure of the system (Ross, 1998).

Inequalities in the healthcare system lead to an unequal protection of rights to medical care depending on needs, thus becoming an injustice.

In Romania all types of inequalities regarding healthcare access are pointed out, aspect which determines health inequities in various groups of population, some communities from different geographic locations and economically-disadvantaged groups.

The main factors that influence access to healthcare are usually represented by level of poverty, unemployment, occupational status, environment, the status of being insured in health insurance system, medical staff coverage.

Although IDU, as shown in the Human Development Report of the United Nations Development Programme, includes Romania in the category of high human development, with a value of 0.781, it can be noticed that numerous problems related to inequity in Romania are mainly due to the lack of access to healthcare of poor population.



**Figure 1.** World Map with IDU areas, report posted on 02.11.2011  
 Source: ro.wikipedia.org/wiki/Lista\_țărilor\_după\_indicele\_dezvoltării\_umane

Many of those who declare that they need health care, they do not actually require it, aspect which is mainly due to some enclaves that are usually located in remote areas, far away from the major road network. This is typical for nearly half of the poor population who lives in villages that are isolated from modernized roads or towns, compared to 20% of the wealthy population. Moreover the gap between the wealthy and the poor is even higher in the treatment of chronic diseases: 42% of the poor population compared to 17 % of the wealthy population, although in reality the gap seems to be higher as the poor population with chronic diseases is not even aware that healthcare is needed. Under the circumstances in which the prevalence of chronic diseases is the same for rich and for poor, a huge percentage of 85% of the poor population that needs medical assistance for these diseases is not likely to benefit of it<sup>2</sup>.

Another aspect related to the healthcare access is that even during the economic growth period the population access to healthcare increased, this increase concentrated mainly among high-income population, increasing from 65% to 81% whereas among low-income population no increase in access was recorded, stagnating at 52%.

Moreover it should be mentioned that both wealthy and poor population most often see family doctors whereas the wealthy population benefits from significantly higher access to specialised medical care (Astărăstoae, 2011).

The scarcity of financial resources allocated to the health sector that continued the trend of inefficient investments recorded between 1990 and 2010, is yet another aspect related to the system inequity

It resulted in an unsatisfactory equipment of health units, lack of state-of-the-art medical supply and utilities as well as low wages paid to medical staff, compared to their self-perceived status. This aspect had direct consequences upon the quality of medical care provided to the population. The perception of the medical staff on their working conditions ensured by the system as well as on their

<sup>2</sup> Cristina Doboș, *Serviciile publice de sănătate și dezvoltarea socială*, paper published in *Calitatea Vieții*, vol. XVI, no.3-4, 2005, p. 8

social status together with the dissatisfaction concerning the low payment is responsible, in their opinion, for their expectations concerning additional payments in cash for medical care (Panaitescu, et. al. 2013). As a consequence, the access of poor population is therefore limited, which in turn perceives the additional payment as a common practice<sup>3</sup>. This habit of expecting additional payments is a problem not only due to high costs incurred by patients with low income, but especially due to the fact that it reveals a lack of preoccupation on the part of the medical staff concerning patients' rights (Kaneva, et. al., 1998).

Moreover, long queues, patients complaining about being humiliated when they have to deal with the healthcare system, or because they have not been able to see a doctor or buy medication when needed, all these aspects reveal a healthcare system that has not responded efficiently to its beneficiaries/patients (Aertsen and Vanfraechem, 2014).

The fundamental objective based on ethical principles is thus violated, namely the one referring to the universal and equitable access to health care services. Overall, it can be said that in most poor communities there is a vicious circle between health and available resources for investing in the health care system; therefore a poorer community is sicker than a wealthy one.

Most European countries have identified connections between inequality, disadvantage and deteriorating health. This is mainly due to the fact that all disparities occurred in the health system are leading to various and inefficient health results of individuals or groups. Therefore the low living standards of the population together with an inequitable health system are leading to poor health of population. Consequently, the health system based on inequities/discrimination shows perfectly the health problems of the population as well as the difficulties of the Romanian health system (Wagstaff and Doorslaer, 1999).

Thus we can say that image, as part of the heritage, requires extensive efforts to earn recognition, respect, goodwill and people's confidence, by influencing its representations depending on the organization's interest, efforts that are focusing, as in the case of the health system, on applying equity and eliminating inequities and discrimination to a great extent.

A positively coherent image provides success to its organization in the competition for resources and public, whereas a negative image – the result of policies and marketing strategies that do not uphold ethical principles - leads to losing the public's interest, increasing morbidity and even significant loss of resources (Blendon, 1991).

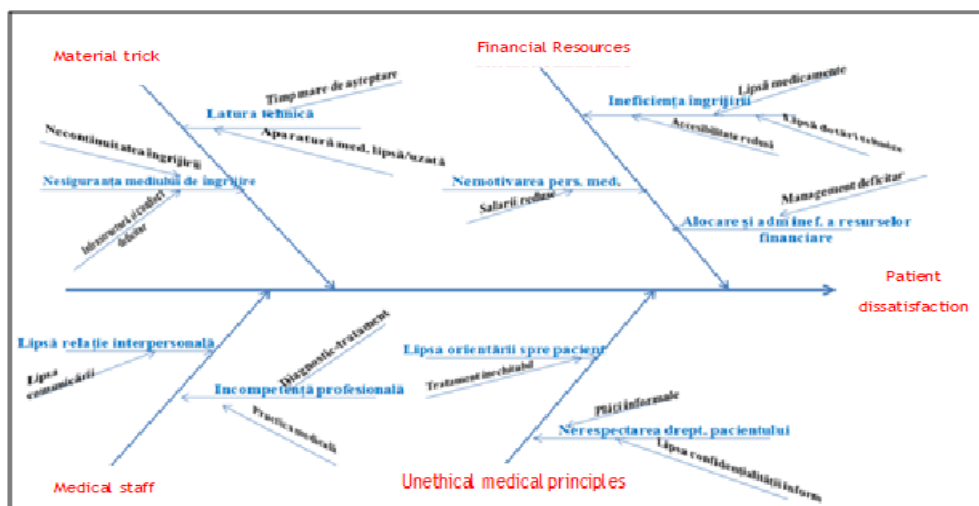
If medical ethics is applied effectively, it results in increasing patient satisfaction and implicitly in increasing the institution's performance. Of course the other variables should not be overlooked such as financial and material resources, medical staff competence that contributes to ensuring quality medical services. However, as the patient says, the human or interpersonal side of health care is highly appreciated, being one of the most important aspects that are considered when they have to assess the quality of medical care (Wagstaff and Doorslaer, 1998). Thus some specialists concluded that *the easiest and most affordable way of*

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<sup>3</sup> Lelia Chiru, *Evoluția în abordarea calității serviciilor de sănătate*, published in *Amfiteatrul Economic*

assessing the quality of medical services is evaluating the patient's satisfaction<sup>5</sup> Therefore a great emphasis is laid on patient satisfaction through all means that are available to the medical institution: financial, material, human resources, without overlooking the policies and strategies that aim at providing medical services based on ethical principles (Milanov et.al. 2000). Due to co-dependent relationship that exists between resources, professional competence, ethical principles and patient satisfaction, in determining the best good practices applied in order to earn satisfaction and implicitly performance of medical institution, the causes leading to *dissatisfaction* should be given utmost importance.

A first method consists in using the cause-effect diagram (Ishikawa) that points out the causes leading to patient dissatisfaction.



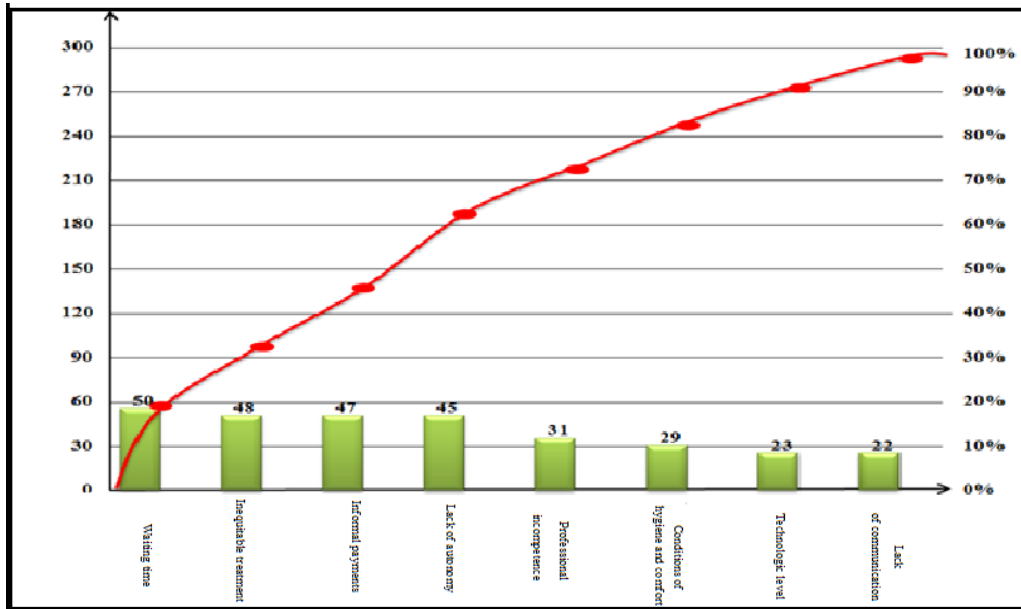
**Figure 2.** Cause – effect diagram (Ishikawa) for the health system

In order to solve the problem related to patient dissatisfaction, we are using the Pareto chart, due to which we can assess the main problems related to patient dissatisfaction. In the present case, 295 complaints were taken into consideration, classified on categories (the values are taken from questionnaires, namely the patient disagreement concerning certain statements) that are presented in descending order depending on the number of the complaints.

No.	Category	Absolute frequency	Cumulative frequency	Relative frequency	Cumulative relative frequency
1	Long Waiting time	50	50	16.95%	16.95%
2	Inequitable treatment	48	98	16.27%	33.22%
3	Informal payments	47	145	15.93%	49.15%
4	Lack of autonomy	45	190	15.25%	64.40%
5	Professional incompetence	31	221	10.50%	74.90%
6	Conditions of	29	250	9.83%	84.73%

	hygiene and comfort				
7	Technologic level	23	273	7.80%	92.53%
8	Lack of communication	22	295	7.47%	100%

The figure below shows the graphic representation of the values that were obtained:



**Figure 3.** The Pareto chart for the health system

According to the Pareto principle, "20% of the problems have 80% of the impact". At first sight, we can notice that almost two thirds of them (64.40%) have as causes waiting time, inequitable treatment, informal payments and lack of autonomy which accumulated almost the same number of complaints. Taking into account that it is easier to reduce a high frequency than a low one, the chart shows that it would be useful to concentrate on the main causes rather than on secondary or those not important (Schneiderman et. al., 2006).

Starting from what we have achieved so far due to the two diagrams, we are trying to determine which methods are considered as good practice for achieving patient satisfaction and performance of medical institution respectively. We can notice that patient satisfaction depends on the financial, material and human resources of an institution, but especially on the interpersonal side.

Thus starting from the above-mentioned aspects but particularly taking into account that in great institutions serious problems are caused by the lack of financial resources, we can consider additional funds (self-financing) as the base of solving unfavourable situations to ensure material and competent human resources required in order to provide quality health care (Simon, 2000). Under these

circumstances, the patient will receive intensive treatment in well-equipped hospitals, benefiting from a wide range of diagnose and treatment methods.

Certain problems such as those related to comfort, infrastructure, medical equipment, diagnostic and inequitable treatment are thus eliminated but especially the waiting time. Also within these hospitals, patients can benefit from better care provided by motivated, well-trained and adequately rewarded personnel for achieving performance and thus several barriers related to professional incompetence and lack of communication are eliminated. Mention must be made here that in such circumstances employees are better motivated, kind and even patient-oriented, willing to uphold their rights (Gakidou et.al., 2006).

If to these additional funds, ethics in health care management is added, aiming at implementing in that organization a patient-centred ethical medical behaviour both through training and by setting up Ethics Commissions whose objectives are to check whether the ethics principles are applied and to which extent, then patient satisfaction is thus ensured besides the performance achieved by the institution which guarantees a positive image on health care market.

## 2. Mathematical modelling and its application to health care

Based on what we know and especially on what we want to achieve, we shall show by using mathematical modelling how a medical institution and furthermore the health care system can achieve performance by applying a formula with known variables.

In order to do so, we shall start from the equation of relativity:

$$E = mc^2$$

in which: *E* – **performance of medical institution**

*m* - **patient satisfaction;**

*c* – **effective delivery of health care;**

According to the equation, the institution's performance is achieved by increasing patient satisfaction with medical service delivery. The higher the variable - *effective delivery of health care*, or even aiming at reaching the maximum level, increased patient satisfaction and this can lead to achieving optimal performance.

In turn, each and every variable is made up of some other variables. Thus effective use of resources “*c*” refers to:

$$c = Rf \times Bm \times Cp \quad (1) \quad \text{where:}$$

**1) Rf - financial resources** of the organization where:

$$Rf = Re + Ri \quad (2)$$

**Re** – *external resources of the organization, government budget;*

**Ri** – *internal resources of the organization, resulted from self-financing;*

$$Ri = a \times Re \quad a\text{- constant in percentage \% (3)}$$

If we introduce equation (3) in (2), it results the following:

$$Rf = (a + 1)Re \quad (4)$$

**II) Bm –material base of the organisation:** *medical equipment, infrastructure, comfort, hospital bed allocation, drugs*, represents a percentage of the organization’s financial resources.

$$Bm = b \times Rf \quad (5)$$

By replacing Rf with the equation (4) we obtain the following:

$$Bm = b \times (a + 1)Re \quad (6)$$

Where b is a constant that represents a percentage allocated from Rf, percentage that depends on the authorizing officer;

**III) Cp –professional competence:** represented as indicators that are used in the health care system to assess hospitals. Below there are three examples in point:

a) **ICM –case mix index** = the total number of cases resolved from those admitted in hospital;

$$ICM = \frac{CP}{CR} \quad \text{where:}$$

CP – Total number of weighted cases

CR – Total number of resolved cases

b) **ICDIE – index of concordance between admission and discharge diagnosis:**

$$ICDIE = \frac{Nr.diag.concordante}{Nr.pacienți\ ext} \times 100$$

c) **PPICH – percentage of patients undergoing surgeries out of the total patients admitted in surgery wards:**

$$PPICH = \frac{No.\ patients\ with\ surgeries}{No.\ patients\ ext.\ from\ surgery\ wards} \times 100$$

$$\text{Thus we obtain } Cp = ICM + ICDIE + PPICH \quad (7)$$

As specialists pointed out, health care delivery is effective if ethical principles are applied, on which the objectives of health care systems are implemented.

Consequently we considered that the variable – *effective delivery of health care* – should be included next to the financial, material, human resources and ethical principles.

**IV) Pm –principles of health care ethics**, with values ranging between (-6,+6) where:

”-6 ” – there is no ethical principle in health care but only social vices. This aspect corresponds to Anghel Rugină’s M<sub>7</sub> model: = **100% e** , however it is regarded as an abstract model.

”+6” – corresponds to total application of principles of health care ethics, ethical social values and corresponds to Anghel Rugină’s M<sub>1</sub> model: **M1 = 100% v**, however regarded as an ideal model, made up of social virtues.

Therefore we shall use for exemplification only the models from M<sub>2</sub> to M<sub>6</sub>, applicable both in theory and in practice, in Anghel Rugină’s view:

$$M2 = 95\%v + 5\%e$$

$$M3 = 65\%v + 35\%e$$

$$M4 = 50\%v + 50\%e$$



$$M5 = 35\%v + 65\%e$$

$$M6 = 5\%v + 95\%e$$

By replacing the variables from equation (1) with equations (4),(6) and (7) we get:

$$c = b(a + 1)^2 Re^2 \times (ICM + ICDIE + PPICH) + Pm \quad (8)$$

The second variable "m", refers to *patient satisfaction* and includes: the interpersonal side – positive relation that is required to be built between doctor and patient and which is based on trust, transparency, communication; access to health care– waiting time for benefiting from the required service, continuity of health care, accuracy of diagnosis and treatment, all these aspects being influenced by the financial resources invested in technical equipment of medical units and improvement of professional competence.

We get the variable  $m = Li + Ac + Cs + Ap$  (9) where:

A) *Li – interpersonal side* = social and psychological relations that are built between doctor and patient, with values ranging from 1 to 5, where 1 corresponds to the statement *very dissatisfied* due to the lack of a relation between doctor and patient and 5 corresponding to the statement *very satisfied* due to a solid relation based on trust, transparency and communication between doctor and patient;

B) *Ac – accessibility to health care* = it refers to the patient's waiting time until they benefit from medical care, with values ranging from 1 to 5, where 1 corresponds to a very long waiting time and in case of an emergency the patient is very dissatisfied; and 5 corresponding to a very short waiting time and when there is no medical emergency, the patient is very satisfied.

C) *Cs – continuity of health care* = contributes to the achievement of a maximum benefit or maximum use of resources. In order to quantify it, we assigned values from 1 to 5, where 1 corresponds to minimum benefit, in which case the patient is very dissatisfied whereas 5 corresponds to the maximum use of resources and the patient is very satisfied.

D) *Ap– accuracy of diagnosis and treatment* = it refers to the quality of health care from all perspectives: technique, communication, speed of intervention, etc. the assigned values are ranging from 1 to 5, where 1 corresponds to a very dissatisfied patient regarding the quality of health care whereas 5 to a very satisfied patient.

By replacing the variables presented above in the equation of relativity, we get the following:

$$E = (Li + Ac + Cs + Ap)[ b(a + 1)^2 Re^2 \times (ICM + ICDIE + PPIC) + Pm ]^2$$

Considering the particularity of hospitals as institutions and service providers, for exemplification, we shall assign certain values to the values presented above, depending on the class of competence. The financial resources are expressed in monetary units, where 1 monetary unit =100.000 ron.

Starting from the fact that there are five categories of competence and that external financial resources invested in hospitals by the Health Ministry, C.N.A.S. - National Health Insurance House and local councils are different from one category to another, the following values are taken as reference values for external financial resources:

- for hospitals included in category of competence I, Re = 20 m. u.;
- for hospitals included in category of competence II and III, Re = 15 m. u.;
- for hospitals included in category of competence IV and V, Re = 10 m. u.

The constants that are used *a* and *b*, are sub-unitary numbers, their values ranging from minimum to maximum, with a tendency of maximizing in order to determine the degree in which this aspect influences patient satisfaction and hospital performance respectively.

For *a* constant we assigned the value min = 1% (0.01), max = 20% (0.02), this percentage ranging according to the manager's ability to attract revenue from sponsorship, accessing health care programs, etc.

Regarding constant *b*, the law requires that the percentage invested in material base to be of maximum 30% of financial resources, the minimum being established by the credit officer, we chose as minimum values = 20% (0.2), and maximum values 25% (0.25) for each of the variants presented above. For the three indicators used for determining *Cp*, we used values presented on DRG, for hospitals included in the five categories of competence, the value being higher as the hospital is included in a higher category of competence. Thus ICM will have values between 0.5 and 2.5, PPICH will have values between 0.5 and 0.85), and ICDIE values between 0.5 and 1.

Several variants shall be further presented, taking into account the category of competence, the values provided by DRG for the three indicators as well as the values of the two constants.

**"A" VARIANT** – hospitals in the category of competence IV and V

Variables	Variant I A	Variant II A	Variant III A	Variant IV A
<i>Re</i>	10 m. u.	10 m. u.	10 m. u.	10 m. u.
<i>"a"</i>	5%	5%	10%	10%
<i>"b,,</i>	20%	20%	25%	25%
<i>ICM</i>	0,6763	0,6763	0,7314	0,7314
<i>PPICH</i>	0,51	0,51	0,58	0,58
<i>ICDIE</i>	0,66	0,66	0,71	0,71
<i>Pm</i>	5%v+95%e	35%v+65%e	35%v+65%e	95%v+5%e
<i>Li</i>	1	2	2	4
<i>Ac</i>	2	2	3	3
<i>Cs</i>	2	2	3	3
<i>Ap</i>	2	3	3	4
<b>TOTAL</b>	<b>8.659,48</b>	<b>13.529,41</b>	<b>38.687,91</b>	<b>57.493,57</b>

If we compare the overall results achieved in variant A, we can notice an increase of total value from variant "IA" to variant "IVA". If we analyse them separately, we shall notice that from variant IA to variant IIA, there has been an increase in value when there are the same values external and internal resources

and investment in the material base. Due to the maintaining of the same level for resources and investment in drugs, medical equipment and supply, the indicators that show professional competence register the same level. On the other hand, the transition of Anghel Rugină's model from  $M_6$  to  $M_5$ , which is due to implementing a management of health care ethics that requires to uphold ethical values concerning the patient led to an increase of *Li* 1►2, and of *Ap* 2►3. However the same values were recorded for *Ac* and *Cs*. This aspect is mainly due the fact that an increased interest in implementing health care ethical principles within an institution, leads to a better interpersonal relation between doctor and patient based on communication, transparency and trust and implicitly leads to patient satisfaction. Establishing *Li*, attracts an increase of *Ap*, not only from the technical point of view but especially from the point of view of communication, of expressing feelings and requirements that must be met. Nevertheless due to the fact that the same level for financial resources and investment was maintained, this led to maintaining the same level of patient satisfaction regarding the waiting time and the possibilities of continuing the treatment within the same medical unit. If we compare the two variants, we can conclude that when there is an attempt to increase patient's interest in the human side, even when there is the same level of resources and investment, patient satisfaction will increase from certain perspectives and implicitly overall hospital performance.

In the second stage, if we compare the variant "IIIA" with variant "IIA", we can also notice an increase in the total value of almost three times the value of variant "IIA". This aspect is due to the increase of investment in material base as a result of the increase in revenue (25% of external resources), and which led implicitly to an increase of indicators that show *Cp*. Moreover an increase in patient satisfaction can be noticed regarding the waiting time (*Ac* 2►3), continuity of health care within the same hospital as well as accuracy of diagnosis and treatment. This is due to an increase in supplies and equipment, employment of competent personnel, the two resources – material and human, making the waiting time shorter for various investigations, possibility of continuing those investigations and treatment, and especially increase in quality of health care. On the other hand, by maintaining the same level for implementing the ethical principles in health care, we can notice that *Li* did not change its value.

Finally, by comparing the last variant with variant IIIA, we can notice a new increase in the total value, when external and internal resources were the same as well as investments in material base. Due to this aspect, *Cp* maintains the same level, as well as patient satisfaction concerning waiting time and the possibility of continuing health care within the same hospital. This is due to stagnation of medical equipment and medical personnel at the same level as in variant IIIA. However if the maximum possible level of ethical principles is reached, model which corresponds to  $M_2$  in Anghel Rugină's orientation table, and depending on the hospital's financial, human and material resources, it will lead to an increase in interpersonal side as well as quality of health care.

We can notice that within the same health care unit if a great emphasis is laid on revenue increase through various connected means, maximizing the percentage for the material base as well as implementing policies and strategies to achieve the objectives of the WHO, the are based on the twelve ethical principles

for health care, then both patient satisfaction and medical unit performance will increase significantly even when the same level of external financial resources is maintained (Vicol, 2011).

In order to point out how these variables influence patient satisfaction and performance of the medical unit, we shall compare variant A with variant B, which is presented in the table below:

**VARIANT "B"** – hospitals included in categories of competence II and III

<i>Variables</i>	<i>Variant I</i>	<i>Variant II</i>	<i>Variant III</i>	<i>Variant IV</i>
<i>Re</i>	15 m. u.	15 m. u.	15 m. u.	15 m. u.
<i>"a"</i>	5%	5%	10%	10%
<i>"b<sub>v</sub>"</i>	20%	20%	25%	25%
<i>ICM</i>	1.0635	1.0635	1.1198	1.1198
<i>PPICH</i>	0,57	0,57	0,64	0,64
<i>ICDIE</i>	0,69	0,69	0,73	0,73
<i>PM</i>	5%v+95%e	35%v+65%e	35%v+65%e	95%v+5%e
<i>Li</i>	1	2	2	4
<i>Ac</i>	2	3	4	4
<i>Cs</i>	3	3	4	4
<i>Ap</i>	3	4	4	5
<b>TOTAL</b>	<b>108.306,81</b>	<b>154.045,40</b>	<b>390.422,62</b>	<b>515.846,27</b>

As it can be seen, variant "A" also reveals an increase in hospital performance from variant "I B" to "IV B", when a constant budget of 15 m. u. is allocated (external financial resources).

Moreover, as in variant "A", performance is higher when revenue increases, investment in material base is maximized and last but not least, a great emphasis is laid on implementing ethical principles in health care and on technical excellence development and humanizing medicine in the spirit of quality.

If we compare the two variants A and B, we can notice that there are significant differences between the results regarding the compliance of criteria concerning the percentage allocated to investment and implementation of ethical principles in health care. The discrepancies are due to different resource allocation in hospitals, classified according to competence. This inequality triggers some other inequalities such as those related to Cp, as higher income enables the treatment of more complex diseases. Also, even when the investment percentage is the same in both variants A and B, however according to the formula, it relates to external resources which are different in A and B and therefore the budget for material base is higher for hospitals included in the category of competence II and III than those in IV and V. This aspect has as consequence the increase of patient satisfaction regarding the waiting time or quality of health care services.

### 3. Conclusions

It can be noticed that on the level of healthcare system, inequities are mainly due to the resource allocation in medical units, because all other inequalities are generated by this aspect, as we pointed out through mathematical modelling.

This is why we recommend mathematical modelling as a method of determining the performance level of the medical unit. Due to this method the main causes leading to the occurrence of unwanted effects can be identified. Moreover it can be determined which strategies to be adopted in order to prevent those effects. Moreover due to mathematical calculations it can be easy to find out to what extent the variables identified can influence patient satisfaction and hospital performance, where to intervene and to what extent. Mathematical modelling emphasizes the following: influence of resources on patient satisfaction and hospital performance when no ethical principles are applied in health care and also how these ethical principles influence the level of effective delivery of health care when the same level of financial resources is maintained. As we mentioned before, in order to achieve health care efficiency, there must be an interaction between ethical principles in health care and elements of the marketing mix.

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