

Strategic modeling of national healthcare policy

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Abstract — the paper analyses current status and future perspectives of healthcare system in the Czech Republic. Based on identification of the key quantitative and qualitative aspects, authors propose a holistic approach to its overall improvement. System dynamics simulations of the most significant relations in the healthcare sector showed that the systematic concentration on quality is the most promising way how to reduce future cost and positively affect structure of unhealthy population. Although the presented research is nationally specific and still in progress, its basic ideas are generally applicable.

Keywords— healthcare, healthcare system, Czech Republic, strategic modeling, loop diagram, system dynamic model, national health policy, STEEP, health insurance, quality

I. INTRODUCTION

Healthcare system is one of the major problems in many countries [1,2,3]. This includes problems related to funding (sustainability), quality and accessibility of health care and efficiency of invested resources. This theme takes on importance mainly due to the nature and perception of healthcare. Financial significance is captured in the annual statistics which shows national expenditures on health care and their share in GDP. These costs differ considerably between countries such as the Netherlands with 12% share on GDP and the Czech Republic with 7.5% of GDP [4]. Health undoubtedly affects all of us. Demand for health services is derived from the demand for health [5]. These aspects together with the psychological component put pressure on the demand for accessible and affordable quality health care. Such conditions are becoming a powerful political tool in two ways. First, allow politicians to get support in the election, and secondly, they create barriers for implementation of major changes to the healthcare system (eg. direct payments, out-of-pocket, fee for service).

As already mentioned, health care is significantly associated with politics. However, the current trend is that the ruling party cannot conceptually use the challenges and solve the problems that are associated with this given the long term

horizon. Often it is decided separately regardless of individual elements or subsystems of the whole health system. However, despite these conditions, in some countries we can find quite significant changes in the state of the health system. It is worth to mention the Netherlands introduced important changes in 2006 that are presented by many experts as a model for other states [6]. Many countries are considering responding to the above-mentioned aspects through reforms. However, to enable us to contemplate changes we need to understand the individual elements of the system, their roles and relationships and interactions between them. Possible solution may be dynamic modeling of the system or its parts, which is based on systems thinking [7,8,9]. Dynamic models allow verifying the functionality and impact of the proposed changes before they are implemented in practice.

II. THE CZECH REPUBLIC CHARAKTERISTICS

Czech Republic's healthcare system is based on compulsory public health insurance. Every citizen pays 13.5 % of his wages. Currently, there are seven health insurance companies (non - for - profit) with dominant national health insurance which serves 60 % insured. In 2012 there were 167 hospitals, most of which are run by a public body, the rest is owned by private subjects. In 2011, the health system operates with a total of approx. 11.22 billion euro. The largest portion of costs were those of health insurance companies (8.64 billion Euro), respective reimbursement of care provided. Households participated in the expenditure of 1.64 billion Euros; it was mainly due to additional charges for drugs, payments for OTC medicines and other expenses for care not covered by the public health insurance. These funds are distributed between providers via credit transfer mechanisms defined in the provisions of the Ministry of Health. This document is reviewed annually by the expected economic developments and requirements of different stakeholders (Ministry, insurers, and providers). This process is associated with a long negotiation, and is based on simple predictions. This approach leads to set of predetermined range of provided care and not entirely reflect the real demand of patients for health services. This does not completely fulfill local and timed availability of health services. Such decisions reactively respond to short-

term developments within a year horizon. This setting takes into account rather quantitative concept rather than the quality of care and in the long run does not prevent increasing costs. Such a system is unsustainable.

III. NATURE OF NATIONAL HEALTH POLICY

National health policy is always looking for a balance between quantity and quality. In other words it is finding a balance between two inconsistent goals, medical (best and most advanced care) and economic (within a limited budget).

A. Quantitative aspects

Quantitative aspects of national health policy include:

- **Tax burden**, because policymakers make decisions about raising or lowering taxes. Similarly, they may decide to reduce or increase the so-called "health tax" (compulsory health insurance). Changing the amount (the percentage from income) of compulsory health insurance is currently unlikely.
- The Ministry of Health (through health insurance companies) can influence **the network of healthcare organizations** to a certain extent which includes number of organizations, structure of healthcare providers (primary care, outpatient care, inpatient care, aftercare).
- Another aspect is **the number of insurance companies**. At this moment all insurance companies offer the same product in the same extent. Moderate competition takes place only in providing benefits packages for different population groups includes voluntary vaccination, promotion of healthy lifestyles, etc.
- The distribution of financial resources between different segments of healthcare system is influenced by adjusting **reimbursement mechanism** (capitation, DRG, fee for packages of services, fee for services and so on).
- **The financial participation of patients** is another quantitative aspect. Such participation may to some extent improve patients' responsibility and awareness of the cost of their own health. But it is necessary to take into account the social aspects of such decisions.

B. Qualitative aspects

Qualitative aspects of national health policy include:

- **Inform people** about chronic diseases and their risks and possibilities of prevention.
- **Educate** people about healthy lifestyle.
- **Encourage** healthy lifestyle of people and healthier behaviors.
- **Build** a better and healthier environment.

- **Improve** coordination of health care services (emphasis on continuity of care).
- **Improved** management - managers seek to continuously improve the quality and increase value-added services in the context of the environment.
- **Implementation** of standards (EBM, quality standards).

C. Main goals of national health policy

The main goal of national health policy is to maximize the adopted penalty function. This penalty function is composed of several indicators. The objective is always to improve these indicators, for example enhancing availability and equity of delivered health care. Penalty function can be summarized in six objectives of effective health system [12,13]. These six goals are called as "STEEEP".

- **Safety** is presented as a reduction of risk of nosocomial infections and injuries acquired during hospitalization or delivering of health care.
- **Timely** means that care is provided to the patients at the time when they need it, thus reducing the waiting times and delays.
- **Effectiveness** means that health care is provided according to the verified and latest scientific knowledge. Comparing the benefits and costs of specific medical procedure and selection of the best alternative we can achieve the effective functioning of the health system in terms of the use of financial resources.
- **Efficiency** is achieved by reducing waste, especially of equipment, materials, labor, ideas, energy, etc.
- **Equity** means that health care is provided to all without distinction, such as gender, ethnicity, socioeconomic-status, or geographic location.
- **Patient-centered** care means that the problems and preferences of patients are respected as far as possible. They are also met the real needs of patients. Structure of delivered health care reflects the structure of the prevalence and incidence of disease in the population.

To these six goals we can also add the indicator of **productivity**, which reflects the relationship between input and output (utility and invested resources) [11].

IV. SYSTEM DYNAMIC MODEL OF NATIONAL HEALTHCARE SYSTEM

To grasp the holistic complexity of the above characterized features, we decided to create a dynamic high-level model of the Czech healthcare system, concentrating on its qualitative aspects. This model served mainly as an initial prototype, justifying the practical feasibility of such approach and its main idea is shown in Figure 1.

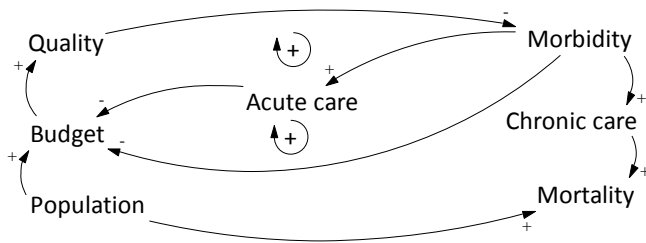


Figure 1 Causal loop diagram of healthcare financing

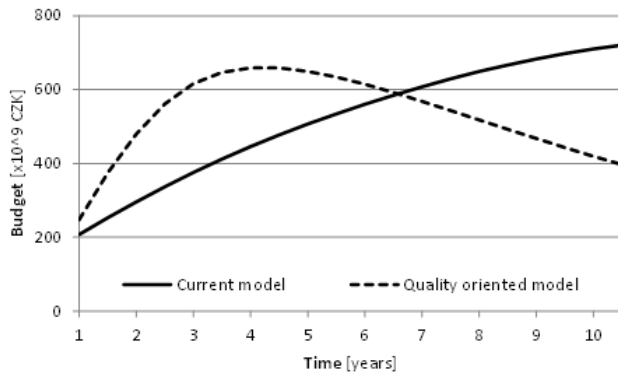


Figure 2 Influence of quality on the national healthcare budget

We consider the current national healthcare policy mainly as reactive and quantity oriented, i.e. it lacks longtime strategies and is driven mostly by actual financial limitations. In case that the proportion of healthy, taxpaying population is adequate, the policy makers could introduce qualitative features on top of the existing quantity. The diagram shows, that the quality minimizes overall morbidity and return a certain amount of patients from acute care to healthy status. These people do not consume healthcare resources and, moreover, contribute to its budget. This influence compensates the implicitly existing negative relation between morbidity and available money.

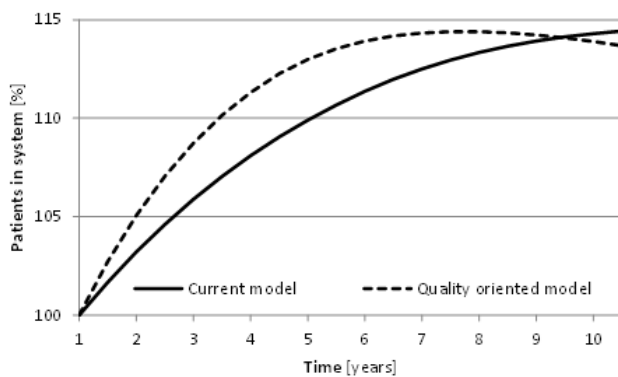


Figure 3 Influence of quality on the amount of patients

This conceptual model was implemented in system dynamics language, representing the analyzed system as a set of stocks and flows, interconnected with network of parameters. Presented model has the following structure:

- **INPUTS:** we do not use any explicit inputs and consider average Czech population with its natural ratios of natality and mortality as endogenous.
- **INTERNAL STATES (stocks):**
 - Quantity of care
 - Quality of care
 - Health status of population
 - Healthy people
 - People in acute care
 - People in chronic care
- **OUTPUTS:**
 - Cumulative costs
 - Total amount of patients
 - Average life expectancy

V. RESULTS AND DISCUSSION

The graphs in Figures 2 – 4 demonstrate the basic behavior of the calibrated system. It is evident, that although the introduction of quality is initially expensive, the total costs start to fall after four years from the beginning of implementation. The break-even point is reached in the year seven and from that time one the new system is even cheaper. The efficiency of the quality oriented model is evident from Figure 3, showing the total amount of patients. Although the proposed system serves more patients till the year nine, its costs decrease from the year four. This is a positive consequence of quality-induced optimization, both structural and parametric. The final graph in Figure 4 says that the change of expected length of life is minimal. This is probably because of natural physiological limitations, which cannot be dramatically stimulated even by the level of national healthcare system.

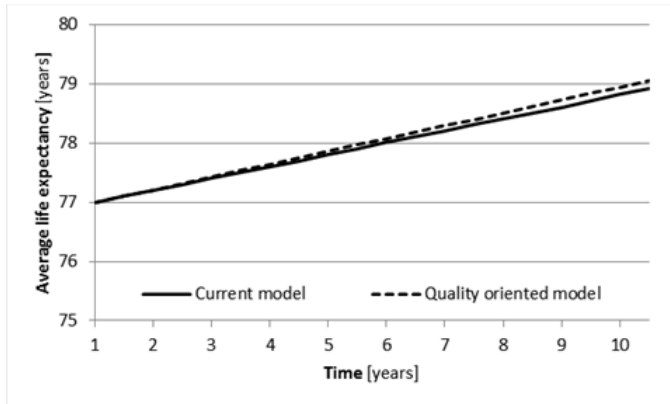


Figure 4 Influence of quality on the average life expectancy

VI. CONCLUSION

The presented results of our research show that the basic decomposition of national healthcare into qualitative and quantitative part is a promising way of its future improvement. Our model, although rough and high level, behaves in accordance with the related historic data and experts' opinions. Thanks to the applied modeling language, we can continuously refine existing diagrams and study more detailed features.

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