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Overview

Trends and challenges in preventive medicine in European Union countries. Comment on the state in Croatia.

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INTRODUCTION. HISTORICAL FRAMEWORK OF PREVENTIVE MEDICINE AND PUBLIC HEALTH

Throughout history, major contributions to population health have come from the initiatives of public health and community-based activities, such as improvements in food supplies and nutrition, sanitary and general living conditions, vaccinations and smoking cessation campaigns. However, the importance of these public measures has not always been corectly verified by the medical establishment, traditionally focused on curing ill individuals. Public health care services have been considered as being too close to social measures and politics and lacking in experimental, scientific methods. In contrast, clinical medicine has been established early on as a branch of science, being oriented towards both, searching for pathogenetic causes of diseases and the scientifically-based treatment (*1*).

Public health has become more scientifically based during the later part of the 19th and the first part of the 20th century, due to the efforts of Robert Koch and Louis Paster. During that time, huge advances in understanding the nature of infectious diseases and their ways of spreading and prevention have been achieved. Dramatic success in the eradication of many dangerous infectious diseases through vaccination and the definition of microbial agents as biological causes of infectious diseases has initiated the strong biological orientation in epidemiology and other public health settings (*2,3*). This has led to the development of experimental research methodologies with focus placed on statistical issues. Many characteristics of modern epidemiology and other public health settings, viewed as a part of science, have their roots in this »golden era«. Analysts agree that these characteristics can be described as an expansion of statistical methods for the measurement of the occurence of diseases in the population. However, by using conventional methods of analysis, diseases are excluded from their natural social and historical context (*1*).

Nevertheless, this was the time of the industrial revolution in western countries which uncovered the importance of socioeconomic factors as implicated in disease onset and the distribution pattern. Ideas on social medicine and public health in historical terms appear in two directions. The first one is conviction that social, environmental and economic condition influence health. The second one is that for the solution of health problems, for improvement of health, prevention and

control of diseases collective actions are needed. For those collective actions, the main responsibility should take public authorities. Public health as defined by CEA Winslow in 1920 started in 19th century (*4*).

Since that time the modern ideas of public health began to be implemented in everyday practice in countries of South Eastern European Region (SEE) which were under different influence, either from the West or East. Slovenia, Croatia and Bosnia and Herzegovina were mostly linked to Western Europe, and Serbia and Montenegro, Bulgaria, Macedonia, Romania, and Moldova were mostly linked to Russia and Soviet Union. That fact had, and even now has, the consequences for the development of public health, organization of health services and health care in this region (*5*).

The most prominent public health person in the SEE region in the second part of the 19th century and beginning of the 20th century was Milan Jovanović-Batut (1847–1940) born in Srijemska Mitrovica, Vojvodina (Serbia). He was the public health educator, writer, teacher and health reformer. His work has great impact on the development of public health in the region. His student and successor was Andrija Štampar (1888-1958), born in the village Drenovac (Croatia), on the border of the then Austro-Hungarian Monarchy. Very early in his life he was exposed to poverty, inequality and injustice of life of rural people. Among other scientists who influenced Štampar by their outlook, special attention should be made of the biologist Ernst Haeckel and Alfred Grotjahn. Social influences to health Štampar experienced and undertaken interventions very intense in countries of former Yugoslavia and China during 30-ties of the last century (*5*).

TRENDS IN MODERN MEDICINE AND PUBLIC HEALTH

Deepening the schism between clinical medicine and public health

The modern era of medicine and public health is characterized by a domination of chronic noncommunicable diseases in morbidity and mortality causes, partially as a consequence of the decline in infectious diseases and partially related to modern lifestyle regarding the urban congestion and technology boom. Based on such background, the schism between medicine and public health has been exacerbated (*1, 3*).

The growing demand to treat complicated chronic diseases has resulted in the expansion of hospitals and other health care facilities. New diagnostic and treatment approaches have been developed. Funds for medical research and total resources in the health care sector have dramatically increased. Clinical medicine, regarding this situation, has become extremely specialized and, as a consequence, narrowly focused (*3*). In its research base, clinical medicine has concentrated on the study of biological mechanisms of diseases and pharmacological treatment, linking the objects of interest more closely to basic sciences, technological innovation and treatment, than to the primary prevention of diseases. In this way, the historical dichotomy between clinical medicine and public health has increased, emphasizing the separation of health care on individually-based and population-based approaches (*1, 6*).

The risk factor paradigm in prediction and prevention of chronic noncommunicable diseases

Public health has been faced with a renewed demand for protecting the public against diseases. This time, the goal was to indentify risk factors for chronic noncommunicable diseases and then to eliminate them through effective preventive measures. This approach is due to the fact that complex chronic diseases are multifactorially caused. That means that there is no known cause for a disease, but multiple factors contribute to the development of a disease (*1, 7*).

Risk factors for cardiovascular diseases were defined as: hypertension, hypercholesterolemia, hyperglycemia, obesity, smoking and sedentary lifestyle (*8*). The discovery of smoking tobacco as a factor strongly associated with lung cancer has further emphasized the paradigm of risk factors approach. Subsequently, many other chemicals with their source in industry, agriculture, general environment, food and consumer products, have been defined as external factors which may contribute to the occurence of cancer (termed carcinogens). These factors, also including ionizing radiation and some syntetically produced drugs, can be supposed as the by-products of advanced technology and environmental pollution (*9, 10*).

During the time, it has been recognized that many behavioural risk factors, such as obesity, low physical activity, smoking, high fat and low fruit and vegetable intake, as well as cumulative stress from various social circumstances, can lead to the development of both cardiovascular diseases and cancer, most likely operating through shared patophysiologic pathways (*11*).

The expansion of preventive actions and programmes. Evidence-based guidelines and recommendations

Successes of the risk factor epidemiology have led to the implementation of a wide-range of preventive interventions, including: legislative measures to restrict tobacco advertising and smoking in public places, health education activities for problems such as obesity or low physical activity, community campaigns for checking high blood presssure, early cancer detection, immunization against influenza, city programmes on initiatives such as bike-paths and parks encouraging physical activity etc. In general, preventive activities can be performed in individual terms and population terms, regarding specific groups, local communities or encompassing the entire population (*1, 3*).

Based on the results of epidemiologic studies and subsequent meta-analyses, EU member states tend to har-

monize guidelines on the prevention of atherosclerotic vascular diseases (*12*). In some countries, comprehensive programmes on the reduction of the burden of cardiovascular diseases and their horrible consequences have been implemented (*13*). Some respective international agencies have prepared recommendations aimed towards the prevention of cancer. Recommendations are based on the estimation that up to one third of cancer cases can be prevented merely by implementation of the principles of healthy lifestyles, by means of a healthy diet, regular physical activity, no smoking and non excessive alcohol consumption. Even better results could be expected if other preventive measures, known to deal with the reduction of total cancer incidence, were systematically applied, including: methods of protection from sexually transmitted diseases, immunization against Human Papilloma Virus and Hepatitis B Virus infection, strictly implemented legislation on the control of occupational carcinogens and avoidance of cancer-causing substances in the global environment (*11, 14*). In addition, the experience of countries where the national programmes of early detection of particular common cancer sites have been implemented, confirms that this approach is the most effective and, in the long run, the least costly method for fighting against cancer (*15*). Recently, an awareness has been growing up that more integrated initiatives are needed in order to achieve overall chronic disease control. Low income and developing countries, dealing with a growing chronic disease burden, should also be included and especially supported (*16*).

The information system

In many EU countries, the information system and the electronic health record has been installed to support practice in the health care system. The emphasis is on assuring that data are collected for administrative purposes and health statistics and exchanged between various departments within the system. However, it is expected that in the near future the information system will provide support for quality improvement, practice-based research and the generation of new knowledge (*17, 18*). The Internet has created new opportunities in disseminating information relevant for behavioral interventions. In particular, early results on computer-tailored prevention programmes are encouraging. In this way, respondents are provided with personally adapted feedback on their present health state and suggestions for change (*19, 20*). Website-delivered guidelines and evidence-based recommendations help physicians in clinical decision-making, support continuous learning and improve their professional capabilities (*17*).

Progress in biotechnology. Personalized medicine

The enormous progress in biotechnology, during the last decades, has been expected to provide benefits by implementing genomics, proteomics and other new sophisticated techniques in health care practice and chronic disease prevention (*21, 22*). Scientific advances have made it possible to diagnose many chronic diseases, notably cancers, much earlier than before (*22, 23*). The great opportunity is also in customizing drug therapy by selecting the best treatment and the right dosage and minimizing the side effects of drugs (*24, 25*). The respective molecular methods include testing for genetic risk profiles that identifies the individual's risk for various diseases and drug responses as well as testing on proteomic patterns in a serum that can distinguish individuals according to their specific physiology and metabolism (*21, 22*). These new approaches stimulate the adoption of personalized medicine in the health care practice (*25*). Other promising areas are nutrigenetics (asks the question how individual genetic disposition affects susceptibility to diet) and nutrigenomics (asks the question how diet influences gene transcription, protein expression and metabolism) having the potential to provide the basis for personalized nutrition (*21, 26*). Knowledge about this could be important when planning the primary and secondary prevention of common multifactorial diseases. Moreover, modern approaches in nutrition are expected to be focused on health promotion, improving health performances of individuals long before early signs of disorders are manifested (*25, 26*).

Dilemmas connected to biotech advances

A rapid progression of biotechnology raises a number of issues on the value of practical applications of new approaches beyond the scope of more traditional ones (*22*). There is a fear of widening the schism between medicine and public health, as the technologically driven healthcare system shifts the attention from the social and environmental causes of diseases to the individual level and the »blaming the victim« paradigm. The direct result is the clear separation between public health interventions and the prevention of high-risk individuals (*1, 27*). Another question is whether or not testing, e.g. genetic traits, is needed to target interventions even at the individual level. In individuals testing negative, this may reduce motivation to change unfavourable behaviour. Also, in cases with positive family history, e.g. on cancer, it is questionable if genetic testing can add value to profile disease risk provided only by a family history (*22*). These and similar dilemmas are further complicated by the fact that the introduction of technological improvements in real life increases the costs of health care delivery and, therefore, potentiates inequties in access to health care (*1, 27*).

On the other hand, many analysts suppose that the »omics era« is the right framework to bring medicine and public health together as partners (*27*). This is supported by the evidence that information obtained from e.g. testing for individual genetic risk profile is generally lacking on the analytic and clinical validity. To assess the clinical utility of genetic tests, evaluation of these tests from the population perspective is needed, estimating their relative contribution to disease occurence in different groups or the population as a whole. In this context, information is required on: the prevalence of high-risk genetic vari-

ants in the population of interest, the strength of the association between these variants and a disease under investigation and interactions between these genetic variants and other genetic and environmental factors. In this way, genetic (biologic) and epidemiologic (population) methods tend to converge onto the common framework (*22, 27*).

Although numerous tests based on discoveries in genomics and proteomics are available for practical purposes, they are not ready for routine applications (*22*). Nevertheless, advances in molecular biology have pointed out a need for transdisciplinary research, including basic sciences, clinical medicine, public health, social sciences, bioethics and policy making, in order to effectively manage the dominant issues in health care today (*3, 27*).

Crisis of methodology

The ongoing debate in research is whether the available methodological tools are appropriate for studying chronic noncommunicable diseases. Shortly, although much efforts has been done on research into causes of chronic complex diseases, a little progress has been achieved in answering the question who will be affected. Analysts agree that possible reasons include the use of methods that have arisen from experimental sciences. They are based on the philosophical postulates of rationalism, by means of reductionistic search for the cause of a disease (*6, 7*). The leading concept of a study design today, »case-control« concept, takes randomization as a technique to control confounding factors. This concept is based on a paradigm of the dichotomy between health and disease. This is not appropriate for studying chronic complex diseases, because they are characterized by multiple causal factors, each having a weak effect. In addition, there is a gradual changing pathway from health to disease (*1, 7*).

There are some other methodological discordances. The risk factor paradigm, used in the probabilistic estimation, is defined at the individual level but analysed at the population level. As a result, the individual's risk cannot be predicted with certainty from group data (expressed by means of the population average) (*1, 6*). Further, each risk factor is treated as having a high predictive power (strong effect). Ongoing preventive actions are based on such an assumption (assuming, e.g., that almost all smokers will develop lung cancer) (*6*). Both, conceptualization of risk factors in individual terms and reductionist thinking in research, has led to a lifestyle approach in preventive strategies and medicalization of treatment (drugs for lowering high blood lipids and high blood pressure), avoiding questions on social and cultural determinants of diseases (*1, 6*). In contrast, it is well documented that healthy lifestyles arise automatically from the ability of a given social environment to allow humanistic and safe everyday life for the majority of its citizens (*6*).

The reductionist search for the cause of a disease, on the other hand, has led to numerous investigations in genetics (*24*). The idea was to find more detailed causes of diseases (*7*). Finally, it has been recognized that the factors used to explain the cause of diseases can operate at different levels of analysis, including molecular, individual and population. A general notion in the research community is that the factors from all levels should be incorporated in assessing individual's risk. Alternatively, the emphasize should be put on using the methodology appropriate for the level of studying, rather than studying factors that fit the method, as is the current situation (*1, 6, 7*).

There are other reasons why the risk factor paradigm does not seem to be a scientifically justified strategy for studying complex chronic diseases. One of them is an observation from a cardiovascular risk factor analysis on the high prevalence of risk factors in the general population (60%-90%), independently of whether the group of ill people is considered, or if it is a matter of the control (*6*). In addition, there is a high heterogeneity (varying combination) of risk factors among people in the population. Exposures to environmental factors are dynamic, changing in number, intensity and combination (*7*). However, except for some theoretical considerations, there is not an alternative to the classical methodology approach (*28*)

CHALLENGES FOR THE FUTURE. STRIVING FOR THE PATNERSHIP BETWEEN CLINICAL MEDICINE AND PUBLIC HEALTH

The current state of the health care system can be summarized as follows: fragmentation on poorly coordinated disciplines, clear separation of clinical medicine and public health and new diagnostic and treatment opportunities based on advances in health care technology and biotechnology (Figure 1). This is followed by a rise in health care costs and the disparity in access to the health care system (*1, 3*). In addition, there is a claim for a more personalized approach in risk profile assessment, prevention and treatment, while, at the same time, an expansion of separate community health campaigns can be registred (*22, 25*).

The current state of research can be described as: confusion in designing observational studies of causality by means of the lack of associations between the knowledge about the biologic mechanisms which underlie diseases and the observed differences in the distribution pattern of chronic diseases across the population, dogmatism in data analysis methods and the lack of alternative approaches (*1, 6, 7*). The growing evidence indicating the biological complexity of common chronic diseases correlates with the increasing number of theoreticians engaged in chaos theory and non-linear mathematical modeling (*29, 30*). An attempt to provide care based on scientific evidence (evidence-based medicine) meets the problem of how to translate the results of the clinical studies, expressed in terms of the average values of studied groups, to be applied to the specific situation of an individual. Also, the challenge is how to integrate knowl-

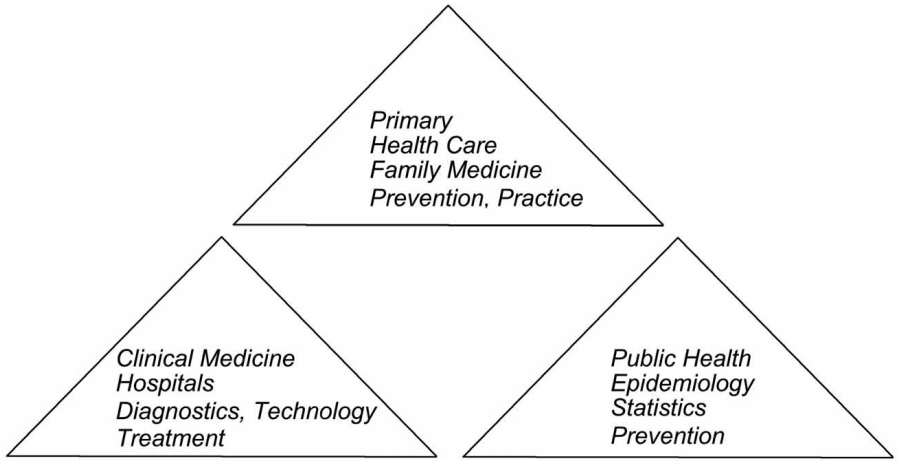

Figure 1. *Present state of the Health Care System organization. Poorly coordinated and communicated sectors.*

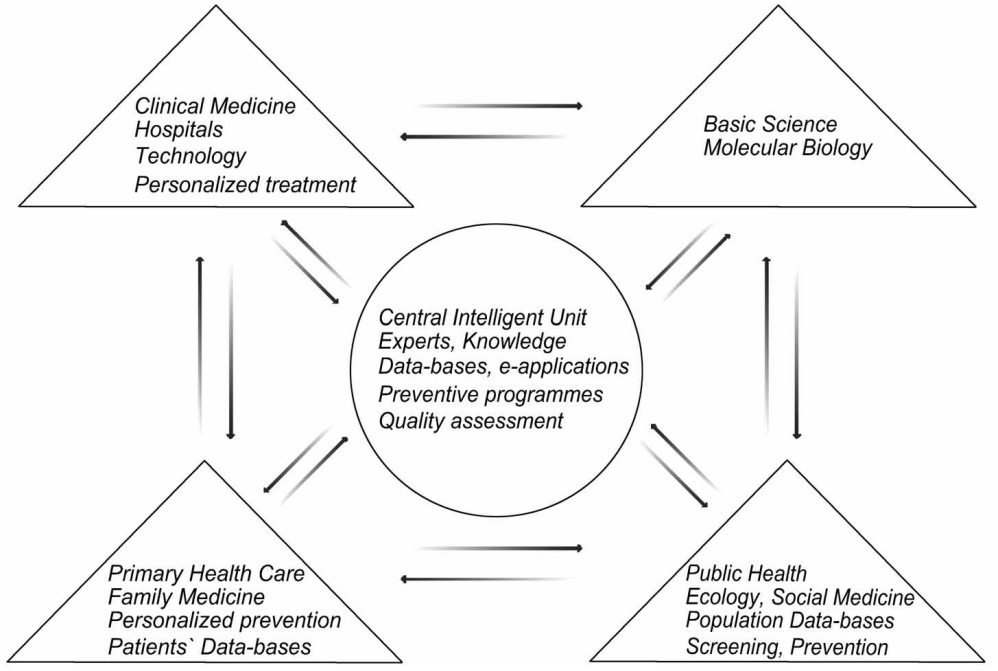

Figure 2. *The Health Care System of the future. Functionally integrated sectors with the Central Intelligence Unit.*

edge on the mechanisms underlying diseases in the holostic vision of a patient as a whole (*6, 7, 31*).

In primary health care, there is a lack of strategies and confusion in searching for practical solutions to the question of how to realize the main objectives such as: patient-centered (ensuring that patient values guide clinical decisions), effective (evidence-based), efficient (cost-saving), safe (not-harming) and equitable (without preferences in access) care (*32*).

Growing awareness shows that systemic and sustained cooperation between all healthcare sectors, at the local, regional and national levels, will be necessary to establish desired vision of the health of the population. This may be achieved through mechanisms such as: common leadership, medicine oriented on quality and outcomes, comprehensive programmes of care supported by shared funds as well as through changes in the education of professionals on ways they can obtain more information from public health and community resources and be able to take on leadership roles in health initiatives in the community (*1, 3, 27*). Politicians should change their way of thinking, by making decisions which are compatible with the goals pointed out in health declarations and the health policy agenda (*1, 3*). Unexploited potentials of family medicine have already been recognized. Emphasis is put on the role of family medicine in the integration of care, the wise use of resources, accessibility, direct communication with the community and adaptability on changes in the local environment (*32*).

VISION OF THE FUTURE. FUNCTIONALLY INTEGRATED AND INTELLIGENCE-BASED HEALTH CARE SYSTEM

It is possible to imagine the way the health care system will be organized in the near future. Emphasis will be put on the prevention of diseases and preservation and improvement of the health of individuals and the population as a whole. The challenges will be in finding out how to prevent or delay the progress of complex aging diseases. Common information and communication technology infrastructure will be necessary for the systemic implementation of the programmed approach in prevention. That means that all stages of the programme's performance are known in advance. Implementation of the programme is based on the collaborative work of interdisciplinary teams. The programme is designed depending on the aims, already identified, and expected outcomes, and is not limited to the level of the health care system organization, type of data, or the method of research. To realize this approach, the health care system should be functionally integrated, with all components communicating with each other and with a central intelligence unit (Figure 2).

Experts in different fields of medicine, mathematicians, computer science theoreticians, programme designers and health managements will cooperate there, performing activities such as: integration of data collected from different sectors of the health care system, comparison of the data provided from the practice with evidence based on existing knowledge, quality indicators development and preventive programme design (Figure 2).

Regarding population oriented preventive programmes, data from local public health service registers will be used, demonstrating characteristics of the population of interest. Data of different types will be collected, including new parameters such as those indicating genetic, cultural, societal and environmental characteristics of the population. For preventive programmes oriented to specific subgroups of patients or individually oriented programmes, data collected in the primary health care practice will be used, enriched by data in genetics, proteomics, metabolomics (provided by the basic science and molecular biology) and population-based data on common societal and environmental characteristics (provided by the public health services). Clinical medicine will be oriented on detailed diagnostics and personalized treatment, based on advances in biotechnology and molecular biology (basic sciences as a source) and using data on population genetics and population biology markers (public health as a source) and on family traits and personal characteristics of an individual (primary health care and family medicine as a source).

If we want to implement such creative medicine in daily practice, sustained efforts in data collecting and analysis will be needed. The emphasis should be put on developing new techniques in data analysis such as the extraction of new knowledge from databases and non-linear mathematics and computer-modeling (*33, 34, 35*). Such medicine will be cost effective, based on evidence, individually-oriented and adopted on the specific features of the population of interest. In such ideal circumstances, prevention, research and the best practice will converge onto the same discipline.

COMMENT ON THE STATE IN CROATIA

At the threshold of the 21st century, the health care system in Croatia, as in other Central and SEE ex-socialist countries, was faced with the transitional process of restructuring. Positive predisposition, inherited from the past, was relatively developed in the health care infrastructure and the primary health care system was respected in Europe because of its favourable performance and a long tradition. As an illustration, Andrija Štampar was one of the founders of the World Health Organization and the Chairman of its first General Assembly. Zagreb School of Public Health was the founder of the Association of Schools of Public Health in Europe – ASPHER. Family medicine specialist training was introduced in 1964, for the first time in the world. International training courses for primary health care managers took place at Zagreb School of Public Health from 1978 to 1996 (*2, 36, 37, 38*).

However, Croatia experienced a war in 1991/92 and its devastating consequences for the economy, health facilities and human resources. New types of health problems, related to the large number of displaced persons, war victims and fast demographic changes, such as difficulties in adaptation, mental disorders and people who require long rehabilitation, have appeared, especially in regions directly striken by war (*36, 39, 40*). In the postwar period, typical health problems for the transitional countries, such as unhealthy behavior of the population and chronic diseases burden, have been exaggerated (*36, 41*). Cerebrovascular diseases, for example, have reached mortality rates significantly above the average for Europe (*42*). In cancer statistics, Croatia holds a high unfavourable position (*43*). Based on this evidence, it is obvious that there is an urgent need for the preventive actions implementation.

A national epidemiologic survey on the spreading of hypertension, obesity and cardiovascular diseases was taken (*44*). However, intervention encompassed only general advice given by clinicians and experts on the need for more intensive nonmedical and medical treatment of cases at higher risk across the population. Initiatives, planned to cope with behavioral problems such as smoking, alcohol consumption, inappropriate nutrition, physical inactivity and drug addiction, were encouraged and evaluated as high priorities (*36, 45*). However, these programmes were not performed in a comprehensive way and had only partial success due to the lack of sustainability, adequate monitoring and follow-up of the results. More attention was paid to the preparations for the implementation of The National Programme of the Prevention and Early Detection of Breast, Uterus, Colorectal and Prostate Cancer (*46*). The Programme started on Oc-

tober 2006 with the screening of breast cancer and, one year later, the Programme for early detection of colorectal cancer was launched (*47, 48*). The objectives, set up by The National Programme, are: to decrease prevalence of risk factors in the population by promotional and education activities, to reduce total cancer mortality rates, to increase a ratio of diagnosed localised cancer compared to the advanced stage disease and to increase early detection coverage of the population. The Croatian Public Health Institute, in collaboration with its county departments, is responsible for the monitoring of the Programme implementation, invitation organization, media campaign and the evaluation of the Programme results (*46*).

All of these preventive programmes, mentioned above, have been carried out by public health institutes, alone, or in collaboration with clinics and health centers, which all are state and county owned (*36*). Nongovernmental organizations, such as The League Against Cancer, have been directly involved in some actions, as partners (*49*). Family physicians have not been formally included in preventive programmes. The reason why they are rather deprived of their historical role in performing preventive measures is that family medicine has gained the specific position in the health care system through the process of privatization of primary health care (*36*). In the present situation, family physicians and other primary health care practitioners such as outpatient pediatricians, primary gynecologists and dentists, are not employees of the Health Center, as they were before, but work in their own enterprises, according to the contract with the Croatian Institute for Health Insurance. Renting facilities is the only connection with Health Centers, formerly integrated institutions responsible for providing primary health care services. Today they are more similar to outpatient clinics.

An idea which preceded the process of privatization of primary health care was to develop decentralized and patient-oriented primary health care and to stimulate the competition between physicians by introducing the capitation fee payment system. The gatekeeping function of family physicians had to be reinforced by establishing a three-year postgraduate training programme in family medicine (*36*). However, an early intention to rearticulate the competencies of family physicians in a fashion that they play a central role in a sustained partnership with patients has become a little frustrating. The health care system as a whole is under the permanent pressure of scarce resources, based on the low-income economy. There is an aspiration of the secondary health care to implement new technologies, ensuring the quality standards. On the contrary, there is an increasing demand for public services to resolve the problem of unhealthy behavior of the population and the growing chronic disease burden. Inefficient management has allowed administrative decision makers to take control. In such a situation, the role of family physicians is more like that of gatekeepers standing between their patients and care rather than being able to serve patients as gateways to appropriate care.

A very recent initiative to establish The Commitee for Primary Health Care at The Ministry of Health reflects a need for the changes. Great expectations were recently put on the process of informatisation of primary health care (*50, 51, 52, 53*). This process is part of a more ambitious plan to develop a common e-Health infrastructure by linking all health care sectors to the central information system. Major short-term benefits are expected in shortening the time needed for collecting data for administrative purposes and in the rationalisation in prescribing medications. In the long run, focus will be put on making quality-measure indicators and on developing the integrated and communicable health care system. Finally, this process leads the way for the implementation of comprehensive and cost-effictive health programmes, involving professionals from various levels of the health care system.

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