European Research Studies Journal
Volume XXIV, Special Issue 1, 2021

pp. 623-643

Management Information Systems of Public Health Behaviors based on Evidence in Medicine and Health Management

Submitted 11/01/21, 1st revision 02/02/21, 2nd revision 03/03/21, accepted 20/03/21

Joanna Holub-Iwan [1]

Abstract:

Purpose: *The article shows the method of modeling population segments on health behavior of patients in Poland and the possibility of including this module in decision-making processes in public health management.*
Design/methodology/approach: *Healthcare systems in different countries are different. However, in each of them it is important to make the right decisions. Health protection is a specific area, quick and right decisions can save health and life. Making decisions based on evidence, facts and research should be a standard. The development of information technology makes it possible to collect and process a big data registered in various systems.*
Findings: *Patient behavior models can be created and they should be part of the MIS. On this basis can be created better predictive models for managers' decision making. Analysis based on a representative research sample of 1067 people.*
Practical Implications: *Institutions responsible for analyzing health care systems report that the use of databases to make decisions about treatment is much more frequent than the use of databases to make decisions about public health management. Doctors use the bases more often than managers. However, doctors do not analyze the health behavior of the population. Healthcare managers should be very interested in creating good and integrating databases.*
Originality/Value: *There are tele-medical devices monitoring the health of people. They should be interested in the integration of databases administered by various institutions, not only medical services providing. In public health Management Information Systems (MIS), can and even need to be included modules related to health behavior of the population. Health behaviors concern preventive health, behavior in health and in illness. The area of health behavior of the population is very large. It is also the influence of the environment on people's decisions - health promotion, pharmaceutical marketing, etc.*

Keywords: *Management Information Systems (MIS), Marketing Information Systems (MkIS), public health, model of patients' health behavior.*

JEL classification: *C13, C22, C53, F31, G11.*

Paper Type: *Research study.*

[1]*Associate Prof., Department of Management, General Tadeusz Kościuszko Military University of Land Forces, Poland, e-mail: joanna.holub-iwan@awl.edu.pl;*

1. Introduction

Issues of the health of societies are always issues stirring up emotions a lot - because it concerns the life and the health of people. COVID pandemic exposed gaps in information systems of the public health - in it methods of recruiting, system storage in databases (of creases date) in the majority of countries of world in it Europe and united States. Diversified strategies of the fight against the pandemic of many governments which their decisions are basing on straight characteristics of patients, are an extreme example so as the age or the pursued profession. The responsibility of States for the health safety of the society was taken into account largely of national constitutions, and very idea of the evenness of citizens in the access to health care (irrespective of the age, the sex, the domicile and the affluence) in the form of strategy of the World Health Organization (WHO) "Health for everyone in the 21st century" was accepted by governments of all WHO member states.

A crucial research problem is a lack implemented of paradigm of the management "based on evidence" - (Evidence - based management EBM) in the area of managing the public health. Indirect purposes are showing, that:

- methods of the decision making based on receipts are already for years applied in medicine - (Evidence - based medicine EBM);
- existing in our times in order to use them in the public health one should considerably widen medical bases for data, for information from the area of health behaviours of the society. For qualitative data collected apart from the system, but simultaneously to it included systems, give on the level e- record of patient;
- exemplification of directions of the conduct of research in health behaviours;
- to use applying analyses which are demonstrating it is possible given from such a system.

Purposes of the article are particularly essential at present in conditions of pandemic of few months and visible in many countries of Europe of the crisis in the decision making in the public health. He is suggesting states and regions the strategy of tricking assisting for managing the public health at using information systems of management (Management Suport Systems MSSs). Later on, the extension of MIS with MkIS, the effectiveness of HMkIS implementation. It is clearly indicated that the success of the implementation depends on a systemic approach, and in particular on the "switching" of managers and entire organizations to a way of thinking and acting based on data, information and evidence. In this sense, Evidence - based management of EBM is the orientation that an organization must adopt in order to use the resources of any information system being designed and implemented. An organization based on evidence-based management (the health system as a whole of entities and decision-makers), and very importantly, will use these systems to make the most economically, socially and politically optimal decisions in the area of public health. decision making that combines the best available research evidence

with the knowledge of the decision maker and customer preferences to guide the practice towards the desired results (Sackett and Rosenberg, 1995).

Health information is described as the "foundation" for improving public health, as the "glue" for managing the health care system, and as an "oil" for keeping the health system operational (Murray, Lopez, and Wibulpolprasert, 2004). The importance of information and information systems in the field of public health is emphasized in the Anglo-Saxon literature (Evans and Stansfield, 2003), giving them a very high rank. Better health information is necessary for better health of citizens and good health information is a "public good" (Murray, Lopez, and Wibulpolprasert, 2004). WHO specialists even emphasize that higher quality health information is associated with a "culture of responsibility" and with the desire to improve the health of citizens and more effective use of health care resources (National and Subnational Health Information Systems, World Health Organization). Strategic dimension information management in health care in developed countries is emphasized in the accreditation standards of medical institutions (Winter, Ammenwerth, and Bott, 2001).

Increasing interest in the development of national health information systems was noticed in the nineties. In 1996, the World Health Organization stressed the necessity to undertake efforts related to health information systems, pointing out that "there is an urgent need to strengthen and coordinate the development of local and national health information systems. These systems should transform data into useful information for health organizing teams (WHO). The proof of WHO's activity in this area was the inclusion in the Millennium Development Goals (High-level forum on the Health Millennium Development Goals, 2012) of the goal related to strengthening health information systems. In 2000, these goals were endorsed by the Heads of Government of 189 countries (WHO). The increase in the importance of information in public health and information systems was achieved not thanks to decision-makers or health care workers, but due to the interest in this issue by international organizations (mainly the World Health Organization) working for public health. Under the cause of organizations such as WHO, the United Nations and the World Bank, a general consensus has been developed around the world on the importance, general goals and functions of health information systems. Efforts to develop guidelines and guidelines for health statistics have been supported by the PARIS 21 initiative, which is an agreement between the World Bank, the Organization for Economic Co-operation and Development (OECD) and the European Union (EU).

With the growing importance of public health information systems, the Health Metrics Network (HMN) was established in 2005, the aim of which is to improve national health systems and coordinate their compatibility, above all, with the information and information technology with the global system. The aim of the organization is, above all, to publicize the issue of individual countries' activity in implementing health information systems due to their importance for health policies.

HMN activities are an opportunity to mobilize governments to invest in sustainable national (and regional) health information systems. The activity of the World Health Organization, the World Bank, the Organization for Economic Co-operation and Development and the European Union is changing the approach of governments and public health communities (doctors, managers) to information systems. Their activities are to build the conviction that for the efficient functioning of health systems in individual countries, a good information system is necessary that integrates "all resources, organizations and decision-makers who are involved in the regulation, financing and provision of activities for which the most important goal is protection, promotion or improvement. health" (National and Subnational Health Information Systems, World Health Organization, 2012).

In the public health literature, the health information system is a prerequisite for strategic planning of health policies and a basic component of improving the health care situation (effect indicators) (Lippeveld, Sauerborn, and Bodart, 2012). Developing effective health information systems brings many benefits and enables making more effective decisions at all levels of health care management. WHO identifies four main benefits (Macfarlane, 2005):

- quickly identifying and controlling endemic health problems. Monitoring the effects of applicable procedures, which concern both the medical area (treatment) and organizational and legal aspects, such as fair access to care,
- access to information has a positive impact on the health of the population by improving the quality of services and access to them, and greater patient interest in the problems of preventive health,
- large-scale data (national databases) provide arguments (evidence) for the development of effective health policies. They allow you to evaluate the effects and compare the results on a large scale,
- better management thanks to the orientation in the quantity and quality of available resources and the need to mobilize new ones (predictable).

The concept of management information systems proposed in the article assumes making decisions in the area of data management, while modern systems with an embedded knowledge base or expert systems assume a constant expansion of knowledge (the system learns), which is to be the basis for effective decision-making processes. The key aspect of the article is the answer to the question of what information, data and opinions should be collected in the broadly understood health care system so that decision-makers can obtain data and indicators from IT systems that will be the basis for making the most appropriate decisions.

2. Evidence-Based Management Development from EBMedicine to EBManagement

Medicine is the first field to successfully institutionalize evidence-based practice (Rousseau, 2006). The beginnings of this process date back to 1847, when I.

Semmelweis discovered the role of infection in puerperal infection. Clinicians in countries such as the United States and the United Kingdom use evidence bases to make decisions.

Evidence-based clinical care evolved as a modus operandi in healthcare organizations after 1990 (Davies and Nutley, 1999). The concept of evidence-based care became recognizable and understood by clinicians, managers, decision makers and researchers in health services (Sackett and Rosenberg, 1995) around the world around 2000. However, work has already been mentioned as the source of this concept (Cochrane, 1972) from 1972 (although the current definition of Evidence - based management is slightly different from the one he used). The first systematization of knowledge in the field of EBM was made by delegates present in 2003 at the Conference of Evidence-Based Health Care Teachers and Developers (Walshe and Rundall, 2001).

The main goal of modern CDSS is to help doctors choose a therapy. Doctors work with CDSS to establish a diagnosis based on an analysis of patient data. Some (so far quite controversial) theories say that CDSS should even make decisions for doctors, the role of a doctor would be limited to entering information into the system and waiting for a CDSS response. Currently, the CDSS system is to combine the knowledge of doctors with the decisions suggested by the CDSS in order to obtain better solutions for the patient. In medical conditions, the value of decision support systems, such as tools free from bias, is particularly important. The expectation of doctors for the decisions of CDSS seems to be mentally unacceptable today, but it should be emphasized that in the future, with the use of artificial intelligence as part of decision support systems, it may turn out to be real. Such possibilities are already created by CDSS systems with an embedded knowledge base (Knowledge-Based CDSS).

In medicine, an EBM tool is also the Clinical Decision Support System (CDSS). The definition of this system was proposed by R. Hayward from the Center for Health Evidence (Walshe and Rundall, 2001): *"CDSS clinical decision support systems link health observations with health knowledge to influence physicians' decisions in order to choose a better quality health care for the patient"*. CDSS is an interactive decision support system (DSS), computer software designed to assist physicians in making decisions about the treatment of a particular patient (Walshe and Rundall, 2001). The EBM tool is a systematic review of scientific publications, which is currently the main method of assessing individual treatments. It is the information base with the broadest range of information (containing the most information?). The most famous and recognized literature review is The Cochrane Collaboration (Cochrane Library).

The systems can support the physician's decisions at various stages of treatment, pre-diagnosis, during and after diagnosis. Prior to diagnostic CDSS systems are used to assist in the preparation of a diagnosis. At the diagnosis stage, the physician may use

the Diagnosis Decision Support System (DDSS) (Walshe and Rundall, 2001) to select therapy together with the patient. DDSS sorts all the proposals in terms of obtaining the best end result. Subdiagnostic systems are used to record links between the patient and their medical history with the purpose of predicting the future.

And the current development of internet technologies, large researched data, data warehouse and the ever-dynamic growth of telemedicine - devices monitoring the development of CDSS systems is heading towards connecting the knowledge base with a much larger amount of data about the patient and the entire population. This approach will be the transition to "quality CRM" systems. Combining medical cases with information on other patient factors is part of the spirit of the "new public health".

Research on the issues of adapting EBM systems to the specificity of the decision-making process of health care managers is carried out by the Center for Management Research (CHMR), established in 1992 by T.G. Rundall's consortium of healthcare organizations and research and development centers. CHMR is a forum where managers, clinicians, and researchers work together to formulate research questions, review existing research literature, evaluate research findings, and demonstrate how decisions can be made based on available research. Thus, CHMR watches over the improvement of public health information and decision-making processes in the world. CHMR pays special attention to supporting evidence-based management decisions. By documenting research evidence, best practices and key lessons for individual healthcare organizations and the system as a whole are identified (Shortell, Bennett, and Byck, 1998).

The implementation of this paradigm in clinical medicine is based on the existence of many unexplained therapies as to the effectiveness of the therapy, the lack of the use of many therapies, which in fact turned out to be effective in results, and poor knowledge about the therapies used (Kovner, Elton, and Billings, 2000). Management sciences have a much greater tool potential in the form of decision support systems, a much greater body of work and a longer history of research. Every information system, from the simplest to the newest generation, is an EBM tool. However, the problem is not the availability of systems or databases, but the propensity to use them, but what K. Walshe and T.G. Rundall is called Evidence-based Culture and all the personality factors of managers.

Progress in the development of EBM in the area of management is definitely slower than that made in clinical trials. There is even some disappointment that despite its popularity among medical professionals, governments, policymakers, and medical facility managers themselves show a lack of interest in evidence-based management (Kovner, Elton, and Billings, 2000). The clearest example of implementing EBM in public health is currently the initiatives to establish organizations and programs, e.g., Cochrane Collaborations (Halladay and Bero, 2000), the UK government research program (Walshe and Rundall, 2001), the Canadian Health Services Research

Fundation (Klein, 1999), Association for University in Health Administration. However, the results in the practical application of evidence to decision making in public health management are modest.

It is worth emphasizing that managers of the health care sector are clearly delayed in the application of evidence-based management - almost all publications indicate a delay in implementing EBM in public health management. The proposed marketing information system in public health management (HMkIS) is part of the Evidence based management trend and is an EBM tool. Its implementation will contribute to making rational decisions based on facts and evidence, which will come from high-quality data. It is worth emphasizing that the concept of Evidence based is also narrowed down to marketing management - Evidence based marketing (Sagan, 2009), but the author recognizes that in the case of the health system, taking into account its specificity, Evidence based should refer to the entire system and not to the marketing area.

The Management Information System (MIS) is the name for the entire group of information and decision-making systems that support management (Wierenga and Van Bruggen, 2009). In 1997, B. Wierenga and G.H. Van Bruggen stated that the term "Management Systems Support" is a collective noun that refers to various systems that had been developed since the early 1960s. All information and decision-making systems mentioned in the literature, such as: Decision Saport Systems (DSSs), marketing knowledge-based systems (KBSs), marketing expert systems - ES) are basically varieties of management support systems (MSSs). The common name organizes individual approaches and enables the classification of systems, and we can say that there are different variants of management support systems that differ in the way of support.

The beginnings of scientific considerations in the field of information systems in marketing are related to marketing models, most often mathematical (Wierenga and Van Bruggen, 1997). The use of models in marketing began in the early 1960s with the work of F.M. Bass, R.D. Buzzel, and M.R. Greene, R.E. Frank, A.A. Kuehn, and W.F. Massy (Buzzel, 1964) and continues today (Lilien, Kotler, and Moorthy, 1994). Examples of early marketing models are MEDIAC (Little and Lodish, 1969) for media planning and S.H.A.R.P. (Bultez and Naert, 1998) to allocate products to supermarket shelves.

Marketing Information Systems (MkISs) appeared in the second half of the 1960s. The very concept of Marketing Information Systems (MkISs) was introduced in 1966 by Ph. Kotler (Kotler, 1966). The prototype was, of course, the concept of a management information system, which was applied to marketing data by Amstutz (1969) and Kotler (1966). The first MkISs were primarily a combination of marketing data and information technology (e.g., data storage and processing systems). Then in the seventies, thanks to R.O. Mason and I.I. Mitroff, T.J. Mock, N.L. Chervany, the concept of decision support / information systems (DSS / IS) has

emerged (Staelin, 1999). Later, further statistical procedures appeared, developing the analytical capabilities of these systems (Brien and Stafford, 1968).

Little (1979) defines MDSS as: *"tools for the coordinated collection of data, models, analytical tools and computing power by which an organization gathers information from the environment and turns it into a basis for action."* MDSS can also be seen as an extension of MkIS, i.e., a combination of information, technology, marketing data and analytical methods, but with a much greater emphasis on analytical methods. The MDSS is especially suited to answering the question, "What if ...?". Using the built-in model, you can perform simulations to find answers to these types of questions. The first MDSSs models, such as the ADBUDG System, were used to forecast the stock market for individual advertising budgets or, like ASESOR, to predict the market share of a new product due to its attributes. The impact of MDSS on marketing decisions can be both direct, when specific decisions are completely automated by the system, and indirect, when decision-makers only take into account the output proposed by the MDSS (van Bruggen and Wierenga, 2009). Management Support Systems (MSS) are divided into systems:

- data-driven;
- knowledge based.

In practice, data-based systems dominate. B. Wierenga, G.H. van Bruggen and R. Staelin explain this with the fact that MMSS have been dominated by scientists who are "model builders".

Knowledge-based systems constitute a new generation of systems, the development of which was initiated with the development of Artificial intelligence (AI). Knowledge-based systems are represented by Expert systems (ES) and Marketing Expert Systems (MES) respectively, which appeared in the nineties, eg ADCAD. The aim of the expert system is to reproduce the knowledge of experts in a computer model. The task of the software is to provide quick and intuitive access to this knowledge. The effectiveness of the use of expert management systems will depend on the best representation of the level of knowledge and the conceptual scope used by health care managers.

Expert systems belong to the broader class of Knowledge Based Systems (KBSs), in the case of management or marketing we refer to Management or Marketing Knowledge Based Systems (MkKBSs), respectively. Case-based reasoning (CBR) and Neural nets (NNs) constitute the basis for the operation of KBSs. Marketing Expert Systems (MES) are a type of SE. The concept of expert systems (also known as expert systems) appeared in the field of artificial intelligence in the seventies, and the first FEM was established in the eighties (Burke, Rangaswamy, Wind, and Eliahberg, 1993). The purpose of the expert system is to map the level of expert knowledge in a computer model. Usually in an expert system, knowledge is represented in the form of "if-then" cause-effect relationships. Generally, the expert

system looks for the "best" solution to a given problem and in this sense has a normative approach that will distinguish it from other systems.

KBSs are defined as decision models that use artificial intelligence methods. KBSs are therefore considered to be learning systems, flexibly adapting, based on the mindset of managers. It is assumed that due to the possibility of learning by these systems, at some point they will start to have "their own" knowledge (generated during work). The knowledge of these systems can be interdisciplinary, for example, when it comes to creating new, unrepresented knowledge. In the case of the health sector, there are many potential areas in which KBSs can create their own knowledge, first by given algorithms and then by their own rules of reasoning. Considering how multifactorial and multifaceted health is determined, many discoveries in this area can be expected, which today may not even be taken into account by humans. At some point, KBSs may become a database that represents the most comprehensive knowledge in the field of public health.

Applications of CBR in marketing appeared in the mid-nineties. An example of Marketing Case-based reasoning (MkCBR) systems are systems for predicting consumers' reactions to a new situation / stimuli. They can be used to predict patient behavior / reactions, for example in the case of introducing private health insurance, changing the benefits package, decisions to vaccinate, etc. Currently, the health sector does not have an adequate case database. Cases can also be collected and entered into the database, but they must be cases for which you have "raw" databases. It is also worth remembering that a small number of cases will make the systems an unattractive management support tool, and may even discourage their managers from using MSS in the future.

One of the newest decision support systems are neural networks (Neural Nets - NNs). Like most expert systems, the NNs are based on artificial intelligence (Al) (Hruschka, 2008). NNs are inspired by an actual physical process that takes place in the human brain, where incoming external signals travel through a vast network of connections and create connections between neurons in the brain (another name for NNs is "connectionism"). A specific feature of NNs is their ability to learn. This process occurs constantly because the system is enriched with examples / queries analyzed on the web. In this way, the experience is automatically included in the neural network and used in subsequent processes. Another specific feature of NNs is the complete absence of a priori theory and therefore the absence of models. The web just adapts to the data. MNNs can also be used in the healthcare sector, as they can be used to segment the patient market, identify incentives influencing patient decision-making, and even formulate diagnoses based on data about the patient's lifestyle, health behaviors or market behavior.

The further development of decision support systems is moving towards collecting data on the individual customer. This type of systems was called: "Customer Relationship Management - CRM, in Poland, Customer Relationship Management

Systems (Dembińska-Cyran, Hołub-Iwan, and Perenc, 2004). The fact that individual clients have become the unit of analysis is considered to be the most important event in the first decade of this century. The beginning of the century is referred to as the "second revolution in information marketing". CRM systems not only store customer characteristics, but also customer interaction data, record purchases and store historical data.

Database integration has been conventionally called the transition to "CRM quality" (Blattberg, Kim, and Neslin, 2008). CRM systems offer great opportunities for the analysis and optimization of marketing activities with the use of customer data. Their important feature is that they learn to understand customer behavior by analyzing the relationship between customer characteristics (e.g., demographic data or purchase history) with other dependent variables (e.g., offer acceptance). When the model gets to know customers, it can be used to predict behavior, e.g., to determine whether other customers with a given feature will accept the offer. Thanks to the intelligent use of data, CRM systems can answer many questions (Reinartz and Venkatesan, 2008) about the attractiveness of customers, methods of their development in the company, and the likelihood of customer resignation from the offer (Neslin, Gupta, Kamakura, Lu, and Mason, 2006).

It is worth emphasizing that despite the fact that managers of the health care sector encouraged doctors to implement EBM, they themselves remained in a significant delay with its application in the area of management in the health sector (Walshe and Rundall, 2001). Almost all publications indicate a delay in implementing EBM in public health management.

3. Health Behaviors of Patients as a Subject of Research and Decision Support Factor in Public Health

Sygit (2009) writes public health covers a wide area of activities concerning almost all aspects of the health of the society. The spectrum of public health activities may include issues ranging from education of citizens (because education improves the quality of life and allows consciously use the achievements of science to maintain health), to technological innovations (in medicine, pharmacy or biotechnology) (Leowski, 2004). The impulse to include non-medical data in Public Health Information systems was the introduction of the concept of the so-called "New Public Health" (Opolski, 2011), analysis of holistic health models (Lalonda, Blum's health paradigm). The spectrum of public health changes as the values important for a given society change (Leowski, 2004). The behavior of patients depends on the model of the health care financing system adopted in a given country and the conditions it creates (e.g., in Poland, a large share of the private sector not regulated by the state). The word "public" in the term public health indicates that we are talking not about the health of an individual, but about the health of the society, population of a given country or region. Public health is characterized by a 'collective' approach, because social, not individual, actions seek to improve social

well-being (Kass, 2001) to provide conditions for a healthier life by minimizing risks that can only be reversed or reduced by action collective. Public health also includes actions to protect the health of individuals, in particular those, the failure of which may worsen the health of the entire population (e.g., purchase of vaccines and compulsory vaccinations, and the risk of disease spreading).

The word "public" clearly identifies events, actions and way of thinking. Therefore, some authors emphasize that public health is associated with a characteristic way of solving health problems, and even with a philosophy of protecting and promoting health. This specificity results primarily from the scale of operations (large populations), which determines both actions, types of decisions, allocation of resources, and the effects of actions of persons responsible for public health.

In 1973, the World Health Organization (WHO) gave a broader, e.g. enriched with infectious diseases, but in fact better, from the point of view of management, definition of public health, which distinguishes key areas related to public health, such as: population health, community health, general health services, health administration. If we consider, as Leowski (2204), that the spectrum of public health changes along with changes in the values important for a given society, an important activity in the area of public health should be monitoring attitudes and behavior of the society. Analyzes in this area may contribute to the enrichment of knowledge about the health factors of the society, but most of all, allow the modification of systemic and organizational solutions that will allow the optimal use of limited resources to raise the population health indicators. Patients' market behavior broadens the scope of public health interest, introducing aspects of marketing management to the issues of public health.

Key to the development of new public health were Marc Lalonde's concept of health fields, the World Health Organization (WHO) strategy "Health for all in the 21st century", the idea of primary health care expressed in the Alma-Ata Declaration of 1976, the Ottawa Charter. Initiatives undertaken by international institutions (mainly by the World Health Organization), declarations related to the idea of health promotion as well as publications and research undertaken in many countries had a great influence on the shaping of the concept of "new public health". J. Opolski, describing the essence of public health, emphasizes the aspect of pro-health development of the human environment in the context of the widely used concept of sustainable development. The high economic growth of countries does not always translate proportionally to the situation of people (the state of health of the population), because this impact also depends on the redistributive intervention of the state, which does not always share resources well and optimally.

The aim of the Marketing Information System in health care (HMkIS) is to obtain continuously and systematically (fluently) information enabling the state to meet the health policy goals in the field of public health and to undertake reform measures

that will enable the selection of optimal system solutions in the future. The Healthcare Marketing Information System (HMkIS) should be used to:

1. shaping the desired quantitative and qualitative structure of services and balancing the normative needs with the needs reported by patients (this postulate will become even more important as a consequence of reducing the "basket of guaranteed services"),
2. faster identification of negative changes in the health sector environment and faster preparation for these changes (this applies both to factors directly affecting the sector and global factors, e.g. development of the private sector, change in social attitudes),
3. shaping optimal social attitudes from the point of view of the health system and the challenges of the future (focusing on prevention Tan and Sheps, 1998).
4. balancing the supply of information on the health of the population with the demand for it among various groups of recipients, in particular managers and patients (through efficient methods of data processing and aggregation),
5. communication with patients (which is related to the postulates of patient empowerment in the health system (Berkowit'z, 2011).

The model of Lalond (1974) aggregates factors that influence public health and the health of society into four groups (de Lueew, 1989; Niżnik, 2004; Włodarczyk, 1996):

(1) the field of biology covering genetics, innate features, maturation, aging and a complex system of internal regulation that can be distinguished in the human body,
(2) the field of the environment including factors operating in the environment outside the human body and affecting its health (social, physical and mental),
(3) the field of behavior, including lifestyle, consumption patterns, employment, health and occupational risk factors, manner of recreation,
(4) the field of health care to which the health care organization system belongs, including the resources and operating procedures of institutions established intentionally for health purposes , prevention, health promotion, treatment and rehabilitation.

The combination of the two concepts presented above is the Blum health paradigm (force-fields and well-being) (Niżnik, 2004). Blum's model is based on three basic assumptions:

1. presenting the concept of the force-fields and well-being health paradigm,
2. taking into account the complex dependencies and political nature of health and health problems,
3. the need for a rational analysis of planning problems in the field of health of the implementation approach.

A large number of factors influencing an individual's health have been grouped into four areas (force-field paradigm approach):

1. population,
2. environment,
3. lifestyle,
4. health services.

4. Research Methodology

The decision-making process of patients is determined by the strong influence of the lifestyle (Crowford, 1987), expressed by the hierarchy of the consumer's life goals. Lifestyle is determined by cultural, geopolitical, economic and individual factors. The position of health in the hierarchy of the patient's life goals is of great importance. Lifestyle is conditioned by adopting a specific attitude towards health (pro-health or anti-health) and is its reflection. It manifests itself primarily in taking up or abandoning pro-health behaviors, which are one of the components of a pro-health attitude. Lifestyle includes consumption patterns, depending on the forms of spending money preferred by a social class or a group of consumers and the type of products purchased. It is a 'set' of factors that can generally determine consumer behavior.

Selected research hypothesis H1: The real demand for medical services is over 30% higher than the normative one (state health care does not meet 1/3 of reported patient needs).
Selected research hypothesis H2: Over 50% of people who receive invitations to free preventive examinations under the National Health Fund do not use these examinations because they do such examinations as part of private health care.
Selected research hypothesis H3: Over 30% of the population does not share the principle of social solidarity, claiming that people who require more care and people who risk losing their health should pay higher contributions.
Selected research hypothesis H4: Over 25% of the population believe that the expectation of higher-quality benefits should be associated with subsidies.
Selected research hypothesis H5: Over 30% of the society believes that health is the private interest of every human being and his responsibility.

The field research was carried out in March-April 2011-2013. The geographical scope of the research covered the territory of the Republic of Poland. The study covered the following population: adult Poles (over 15 years of age) residing in the territory of the Republic of Poland on the day of the study. The more simply the population is defined, the easier the selection of the research sample (Chrchill, 2002). The determinant of specifying the general population should be the existence (possibility of reaching/preparing) the sampling frame. For such a specified population, there was a sampling frame, a list of residents based on the PESEL system. The size of the main research sample was 1067 people (confidence level α =

0.05, standard error level of the mean or fraction at the level of a maximum of 3% of the feature value). The sample was selected in a way that ensures the representativeness of the sample results. The main purpose of selecting a sample that ensures representativeness is to be able to generalize the results to the entire test / general population, with the probability equal to the confidence interval (e.g., 95%, 99%). The key to generalizing conclusions from the sample to the wider population is probabilistic sample selection.

The representativeness of the test sample can be obtained by using an appropriate sample selection procedure. In the study, in order to meet the requirements of representativeness, one of the methods belonging to the random, probalistic methods - stratified goods - proportional (EPSEM (equal probability of selection method). E. Babbie, 2011) was used to select the sample. The study was conducted using the Computer Assisted Telephoning Interview (CATI) technique.

5. Analytical Methods

The group of such methods includes factor analysis methods, which are a set of statistical methods and procedures that allow to reduce a large number of studied variables to a much smaller number of mutually independent factors or principal components. The main purpose of the use of factor analysis is the identification of common factors hidden in the set of variables and the transformation of the system of variables into a qualitatively new set of main factors (Ferguson and Takane, 1999) and a synthetic presentation of the set of multivariate observations (Crawford and Lomas, 1980). As part of the research carried out in the study, an attempt was made to distinguish factors that are decisive in the decision-making process related to patient behavior on the medical services market. An exploratory factor analysis was carried out using the principal components method using the orthogonal rotation of factors - Varimax with Kaiser normalization (Rószkiewicz, 2002). The analysis was carried out on the basis of the following stages:

(1) preliminary analysis of the correlation Table,
(2) assessment of the adequacy of the sample to the assumptions of the factor analysis method,
(3) analysis of the first solution,
(4) factor rotation,
(5) selection of factors,
(6) interpretation of factors and naming of factors,
(7) analysis of the hierarchy of factors.

Market segmentation is one of the most important marketing tools, hence the number of scientific studies in this area is very large. Theoretical studies dominate, but also, as indicated by Wedel and Kamakura (1999), there are many empirical studies. Selecting patient groups that allow for individual strategies and approaches, conditioning more effective and sometimes more effective actions (e.g., by more

precise use of marketing tools and incentives) can also be achieved by using correspondence analysis. This analysis belongs to the group of multidimensional methods of studying interdependence and is a tool that allows to study the coexistence of categories of two or more nominal characteristics describing objects (e.g., respondents) (Borkowski (ed), 2010).

Table 1. *The values of loads at the designated factors in the equations of the individual variables of the observed factor analysis model*

Variables	Factor 1 "patient care"	Factor 2 "Way of paying for medical services in the private sector"	Factor 3 "Surcharges for higher quality of service or treatment methods"	Factor 4 "Difficulties in using medical services under the state health service"
x_6 - lack of trust in doctors in the state health service	0,843			
x_7 – inappropriate approach of the doctor to the patient	0,753			
x_9 – lack of appropriate equipment in state institutions	0,641			
x_1 – paying directly for each service performed		0,756		
x_2 – payment of a monthly premium that does not result in accumulation of resources ensuring access to basic medical care		0,833		
x_3 – payment of a monthly premium that does not cause accumulation of funds to cover the costs of hospital treatment		0,698		
x_4 – payment of a monthly premium with accumulation of funds		0,509		
x_{11} – the amount of the premium depends on the frequency of using medical services			0,893	
x_{12} – treatment paid for with the funds accumulated by the patient			0,893	
x_{13} – reimbursement of costs incurred for treatment in private institutions			0,732	
x_{14} – access to some services paid individually			0,685	
x_5- waiting too long to see a doctor				0,841
x_8 – difficulties in getting to the doctor on time				0,775
% explained variance	**30,530**	**14,650**	**13,790**	**8,591**
Cumulative% Variance	**30,530**	**45,180**	**58,970**	**67,561**

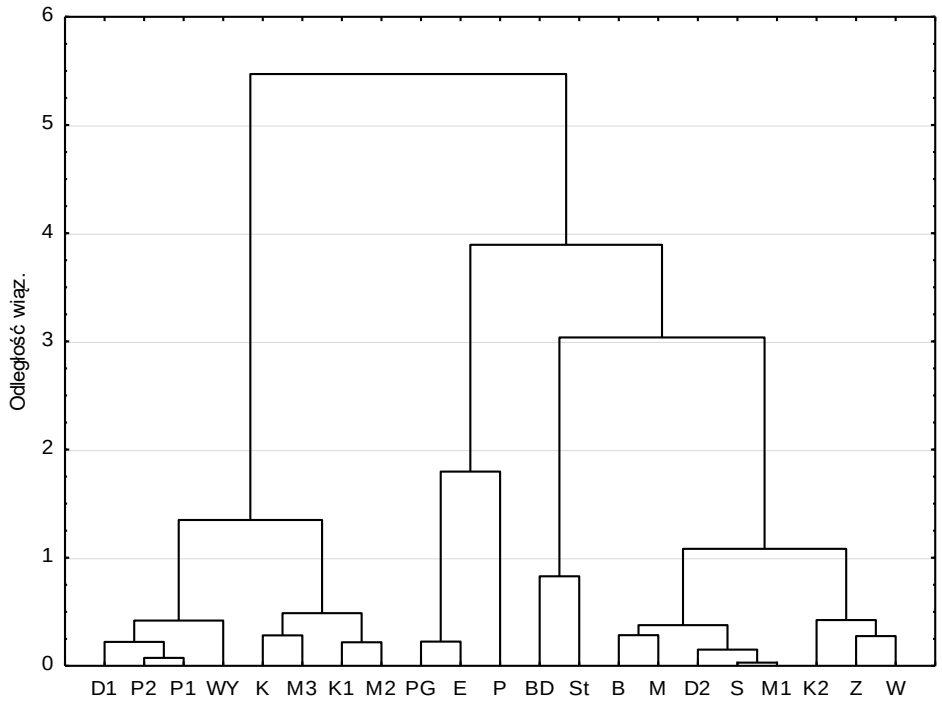
Source: *Prepared on the basis of primary research [N = 1067]*

Stanimir (2005) points out that when considering multiple features, a multivariate analysis is used, using one of the four methods of recording the observed abundance

of the feature categories: (1) a complex matrix of markers, (2) Burt's matrix, (3) multivariate contingency analysis, (4) combined contingency Table.
The work uses the second method of data recording, i.e., the Burt matrix, which is most often the basis for correspondence analysis (Figure 1). Then, the dimension of the real coexistence space (K) was determined based on the formula (Bąk, 2010):

$$K = \sum_{q=1}^{Q} (Jq - 1)$$

Figure 1. *Diagram of hierarchical classification of the categories of demographic and social variables made using the Ward's method*



Source: *Prepared on the basis of primary research [N = 1067]*

5. Conclusions

Grouping of individual determinants from the factor analysis describing patient behavior allows for the identification of factors that are assessed jointly by service recipients. Dimensionality reduction led to the determination of four new variables regarding aggregate patient attitudes towards selected areas related to the provision of medical services. The presented Table 1 shows that:

• The first factor is best explained by the variables related to the 'patient care' aspects. Factor 1 - "patient care" is related to the quality of the services provided by the doctor, in particular the relationship between the patient and the doctor. It includes such variables as: trust in doctors in the state health service, doctor's approach to patients in the state health service, lack of appropriate equipment in state institutions. The determinants described by this factor are related to patients' decisions about the choice of the medical services sector they use: state or public. In this case, they concern the resignation from state health protection. This factor includes "soft" variables that influence patient decision making.
• The second factor relates to the "payment for services" aspects and includes the financial aspects related to the use of services in the private sector. Factor 2 - "way of paying - financial factor" integrates the variables related to the way of paying for medical services in the private sector, taking into account the current needs of patients, such as frequency of use of services, health status, etc. An important factor influencing patient behavior and their decisions related to the use of services will be affiliation to subscription systems, insurance or coordinated care. This group of variables includes almost all methods of payment for medical services in the private sector available on the market, except for the most important, i.e. direct payment. Having a subscription, additional health insurance or an account makes patients feel a bit more free in making decisions about using the services. This eliminates a number of patients' risks, such as uncertainty about the amount of the service fee, doctor's choice, etc.
• A third factor describes the attitudes of patients regarding "patient co-financing of higher quality of service or treatments". Factor 3 - "subsidies for higher quality of service or treatment methods" shows the impact of attitudes in the area of subsidies to medical services on decisions made by patients. Grouping in one factor the variables related to the consent to subsidize services in exchange for higher quality of services in connection with the use of, for example, the most modern technologies of research or surgery, and in the event that patients expect greater availability of specialists, individual rooms in hospitals, etc., indicates grouping expectations of patients in this area of medical services.
• The fourth factor is related to the so-called patient service logistics, such as waiting times and the difficulties that must be overcome to get to the doctor, ie "difficulties in using medical services within the state health service". Factor 4 - "difficulties in using medical services within the state health service", groups variables of "logistic nature related to the ease / difficulty of using medical services." The grouping of these variables under one factor indicates that for certain groups of patients a significant impact on their behavior and making decisions about the choice of sector will have the waiting time for services, the effort that must be made to get to a specialist and obtain help. Time has an economic dimension here, and therefore a financial factor.

The development of EBM is also based on the advancement of information technologies, which enable the collection of an increasing number of data and library

resources, conducting analyzes on a huge amount of data, and sending both data and resources quickly over long distances (Chalmers and Altman, 2001).

The paradox of the present day is the lack of information and its excess (Hołub-Iwan, 2009). It proves the poor quality of information and the inability to use information in decision-making processes. A system error is revealed in the approach to information: (1) it is not about the quantity of information, but its quality, (2) a processing system is needed, not the gathering or generation of information, (3) the use of information and information systems largely depends on managerial skills, (4) it is not about information needs because they are usually generated a lot, but for decision needs.

Only 28% of information from the field or specialty of their interest reaches the "power elite", including only 25% of "strategic" information necessary to make correct decisions. As F. Krawiec states, "Companies lack not the capacity but the context" (Krawiec, 2003). The present day requires a completely different approach to Evidence Base Management in health care. The starting point in these issues is the mentality of managers about building a management culture based on knowledge, facts and data - Evidence - base Culture (Walshe and Rundall, 2001) and learning through research “learning trougth research”.

References:

Amstutz, A.E. 1969. Market-Oriented Management Systems: The Current Status. Journal of Marketing Research, 6.

Babbie, E. 2005. Badania społeczne w praktyce. PWN, Warszawa.

Badania przestrzenne rynku i konsumpcji. 1992. Przewodnik metodyczny, S. Mynarski (red.). PWN, Warszawa.

Bąk, I. 2010. Zastosowanie analizy korespondencji w badaniu aktywności turystycznej emerytów i rencistów. In: Metody ilościowe w badaniach ekonomicznych, Vol. XI, No. 2, B. Borkowski (red), Wydawnictwo SGGW, Warszawa.

Berkowit'z, E.N. 2011. Essentials of health care marketing. Jones & Bartlett Learning, United Kingdom.

Blattberg, R.C., Kim, B.D., Neslin, S.A. 2008. Database Marketing: Analyzing and Managing Customers. Springer, New York.

Brien, R.H., Stafford, J.E. 1968. Marketing information systems: A new dimension for marketing research. Journal of Marketing, 32(3).

Bultez, A., Naert, Ph.A. 1988. SH.A.R.P: Shelf Allocation for Retailers’ Profit. Marketing Science, 1.

Burke, R.R., Rangaswamy, A., Wind, J., Eliahberg, J. 1990. A knowledge-based system for advertising design. Marketing Science, 9(3).

Buzzel, R.D. 1964. Mathematical Models and Marketing Management. Boston: Harvard University, Division of Research. In: B. Wierenga, G.H. Van Bruggen, The Integration of Marketing Problem-Solving Modes and Marketing Management Support Systems. Journal of Marketing, Vol. 61.

Chein, I. 1981. An Introduction to Sampling. In: Research Methods in Social Relations, C. Selltiz (red), Holt, Rinehart and Winston, New York.

Churchill, G.A. 2002. Badania marketingowe. Postawy metodologiczne, PWN, Warszawa.
Cochrane, A.L. 2001. Effectiveness and Efficiency: Random Reflections on Health Services.
Crawford, I.M., Lomas, R.A. 1980. Factor analysis – a tool for data reduction. European Journal of Marketing, vol. 14, no. 7.
Crowford, R. 1987. A cultural account of „health": Control, relase and the social body. In: Issue in the political economy of health care, J. McKinlay (ed.), Trvistoc, London.
Davies, H.T.O., Nutley, S.M. 1999. The Rise and Rise of Evidence in Healthcare. Public Money and Management.
de Lueew, E. 1989. The same resolution. Van Gorcum, Assen/ Maastricht, Netherlands.
Dembińska-Cyran, I., Hołub-Iwan, J., Perenc, J. 2004. Zarządzanie relacjami z klientem. DIFIN, Warszawa.
Dziechciarz, J., Walesiak, M. 1995. Metoda detekcji interakcji (AJD) w badaniach marketingowych. Badania Operacyjne i Decyzje, nr l.
Evans, T., Stansfield, S. 2003. Health information in the new millennium: a gathering storm? Bulletin of the World Health Organization, 81(856).
Expert Committee on public health administration. 1952. First Report, WHO Technical Report Series, no 55, WHO, Geneva.
Fader, P.S., Hardie, B.G.S., Lee, K.L. 2005. Counting your customers the easy way: An alternative to the pareto/NBD model. Marketing Science, 24(2), 275-284.
Ferguson, G.A., Takane, Y. 1999. Analiza statystyczna w psychologii i pedagogice, Polskie Wydawnictwo Naukowe. PWN, Warszawa.
Halladay, M., Bero, L. 2000. Implementing Evidence-based Healthcare. Public Money and Management, 20(4).
Hawkins, D.I., Best, R.J., Coney, K.A. 1898. Consumer Behaviour: Implications for Marketing Strategy. Homewood, Boston, 393-394.
High-level forum on the Health Millennium Development Goals. 2004. World Health Organization, Geneva. http://www.who.int/dg/lee/speeches/2004/mdgforum_geneva/en/
Hołub-Iwan, J. 2009. Systemy Informacji Marketingowej a wiedza pertynentna. In: Współczesne i perspektywiczne kierunki badań w zarządzaniu przedsiębiorstwem, J. Rokita, W. Czakon, A. Samborski, Prace naukowe Akademia Ekonomiczna w Katowicach. Katowice.
Hruschka, H. 2008. Neural nets and genetic algorithms in marketing. In: Handbook of Marketing Decision Models, B. Wierenga (ed). Springer, New York.
Kass, N.E. 2001. An ethics framework for public health. American Journal of Public Health, 91(11).
Kickbush, I. 1994. Life-styles and health. Social Science and Medicine, no 2.
Kotler, Ph. 1971. Marketing Decision Making: A Model Building Approach. Harper and Row, New York.
Kovner, A.R., Elton J.J., Billings, J. 2000. Evidence-based Management. Frontiers of Health Services Management, 16(4), 3-46.
Krawiec, F. 2003. Strategiczne myślenie w firmie. Difin, Warszawa.
Lalone, M. 1974. A new perspective on the health of Canadians, A working document of Canada. Ottawa.
Leowski, J. 2004. Polityka zdrowotna a zdrowie publiczne. Ochrona zdrowia w gospodarce rynkowej. CeDeWu, Warszawa.

Lilien, G.L. 1994. Marketing Models: Past, Present and Future. In: Research Traditions in Marketing, G. Laurent, G.L. Lilien, B. Pras (eds.), Kluwer Academic Publishers, Boston.

Little, J.D.C. 1979. Decision Support Systems for Marketing Managers. Journal of Marketing, 43.

Little, J.D.C. 1970. Models and Managers, the Concept of a Decision Calculus. Management Science, 16, B466-89.

Macfarlane, S.B. 2005. Harmonizing health information systems with information systems in other social and economic sectors. Improvements to data systems for the health sector. Bulletin of the World Health Organization (WHO): The International Journal of Public Health, Geneva.

Murray, C., Lopez, A., Wibulpolprasert S. 2004. Monitoring global health: time for new solutions. Call for a new global health monitoring organization. British Medical Journal (BMJ).

National and Subnational Health Information Systems. 2005. World Health Organization, Geneva.

Neslin, S.A., Gupta, S., Kamakura, W., Lu, J., Mason, C.H. 2006. Defection detection: Measuring and understanding the predictive accuracy of customer churn models. Journal of Marketing Research, 43, 204-211.

Niżnik, J. 2004. W poszukiwaniu racjonalnego systemu finansowania ochrony zdrowia. Branta, Bydgoszcz Kraków s. 26-27.

Pociecha, J. 1996. Metody statystyczne w badaniach marketingowych. PWN, Warszawa.

Rangaswamy, A. 1993. Marketing Decision Models: From Linear Programs to Knowledge-Based Systems. In: Marketing, Handbooks in Operation, Research and Management Science, Volume 5, Marketing, J. Eliashberg, G.L. Lilien (eds.), North Holland, Amsterdam.

Reinartz, W.J., Venkatesan R. 2008. Decision models for customer relationship management (CRM). In: Handbook of Marketing Decision Models, B. Wierenga (ed.), Springer, 291-326.

Rószkiewicz, M. 2002. Narzędzia statystyczne w analizach marketingowych. Wydawnictwo C.H. Beck, Warszawa, 104.

Rousseau, D. 2006. Is the such a thing as "Evidence Based Management". Academy of Management Review, Vol. 31, no. 2.

Sackett, D.L., Rosenberg W.M. 1995. The Need for Evidence-based Medicine. Journal of the Royal Society Medicine, 88(11), 620-624.

Sagan, A. 1996. Kierunki badań segmentacyjnych rynku. Zeszyty Naukowe, Akademia Ekonomiczna w Krakowie, Kraków, 479, 65-78.

Sagan, A., Łapczyński, M. 2009. Techniki segmentacji w badaniach rynkowych. Materiały szkoleniowe StatSoft Polska.

Sagan, A. 2009. Metaanaliza danych w marketingu zorientowanym na dowody – orientacja kliniczna w badaniach rynkowych i marketingowych. Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław, nr 51.

Sprague, R.H.Jr. 1989. A Framework for the Development of Decision Support Systems. In: Decision Support Systems. Putting Theory into Practice, R.H. Sprague, H.J. Watson (eds.), Upper Saddle River, Prentice-Hall, New York, 9-35.

Stanimir, A. 2005. Analiza korespondencji jako narzędzie do badania zjawisk ekonomicznych. Wydawnictwo AE we Wrocławiu, Wrocław, 42-51.

Tan, J.K.H., Sheps, S. 1998. Health decision support systems. Aspen Publishers, Inc., Maryland.

van Bruggen, G.H., Wierenga, B. 2009. Marketing Decision Making and Decision Support: Challenges and Perspectives for Successful Marketing Management Support Systems. Foundations and Trends in Marketing, Vol. 4, No. 4, 269.

Walesiak, M., Bąk, A. 1997. Realizacja badań marketingowych metodą conjoint analysis z wykorzystaniem pakietu statystycznego SPSS for Windows, Wydawnictwo AE we Wrocławiu, Wrocław. In: M. Walesiak, A. Bąk, Segmentacja rynku z wykorzystaniem metody conjoint measurement. In: Zastosowanie metod wielowymiarowych w badaniach segmentacji i selektywności rynku, S. Mynarski (red.), Wydawnictwo AE w Krakowie, Kraków.

Walshe, K., Rundall, T.G. 2001. Evidence – based management: From Theory to Practice in Health Care. University of Birmingham University of California in Berkeley, The Milbank Quarterly, Vol 79, No. 3.

Wedel, M., Kamakura, W.A. 2010. Market Segmentation. Conceptual and Methodological Foundations. Kluwer, Boston-Dordrecht-London, Metody ilościowe w badaniach ekonomicznych, Vol. XI, No. 2, B. Borkowski (red), Wydawnictwo SGGW, Warszawa.

Wierenga, B., Van Bruggen, G.H. 1997. The Integration of Marketing Problem-Solving Modes and Marketing Management Support Systems. Journal of Marketing, Vol. 61, 21-37.

Winslow, C.E.A. 1920. The untilled fields of public health. Science, vol. 51, 23-33.

Włodarczyk, C.W. 1996. Ochrona zdrowia w społeczeństwie demokratycznym. Vesalius, Łódź – Kraków – Warszawa.

Zastosowanie metod wielowymiarowych w badaniach segmentacji i selektywności rynku, S. Mynarski, Wydawnictwo AE w Krakowie, Kraków 1999.