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PERSONALIZED MEDICINE AND ITS TERMINOLOGY

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Abstract. *Personalized medicine is a new and evolving branch of medicine, which stresses the uniqueness of each individual and the uniqueness of his health and diseased state, so it's important to tailor treatment for each patient. Currently its terminology is developing and represents the interaction of several self-consistent and sometimes even remote term systems like biology, genetics, pharmacology, oncology, neurology, cardiology on the one hand, and insurance, economics, law, and ethics on the other hand. Borrowed lexical units undergo some*

semantic changes for they can respond to the needs of this new developing science. The language of Personalized Medicine can be described as a peculiar cognitive and communicative world and can be represented as a frame.

Key words: *personalized medicine, concepts, medical terminology, frame, subframe, word-building*

The first doctor who stated the uniqueness of each person was Hippocrates. However, the idea that every disease was marked by a list of specific characteristics and symptoms that all patients in this group would typically display has been a central theme in medicine. Not long ago the attention was turned to the innumerability of differences between people due to the differences in lifestyle, diet, genetic makeup, and so forth. In fact, “the more we know about differences between people in molecular, lifestyle, and other terms, the further we get away from the notion that any two people express the same disease in the same way” [16]. Understanding of individual variations among people gave rise to the feeling that conventional approach “one-drug-fits-all” turned out outdated and ineffective, because the drugs developed to be used for a large population failed to benefit every patients who it was prescribed for. It is accounted for the person’s unique molecular and genetic profile and the existing concept does not hold and a more individualized approach is needed. It resulted in the development of personalized medicine the aim of which is “to match the right drug to the right patient and in some cases even to design the treatment for a patient according to genotype and other individual characteristics” [14, p. 1]. However, scientists admit that «true personalized medicine is limited today, largely due to a lack of sufficient basic knowledge regarding disease and patient heterogeneity, and limited diagnostic tools to identify such heterogeneity. For most diseases, we are a long way from achieving personalized medicine. In addition, the issues that recent advances in the postgenome era have brought to the forefront of therapeutics that impact on the attainment of personalized medicine are burdensome and complex [19, p. 28].

The term Personalized Medicine (PM) was first used as a title of a monograph by Kewal K. Jain in 1998 [14, p. 1]. Nowadays this novel branch of medicine has many names (P. Cullis and K. Jain singled out about 17), which highlight different aspects of its subject. The names

personalized medicine, personified medicine, individualized medicine or *individual-based therapy* disclose the importance individual characteristic of each patient. *Precision medicine, stratified medicine, systems medicine, and tailored therapy* highlight the accuracy and systematicity of the investigation and treatment. The names *genomic therapy* and *genotype based therapy* bring to the forefront the role of genetics in the development of diseases and the fact that PM results from the advances in DNA and RNA molecules investigations. The term *translational medicine* represents the correlation between biotechnology, molecular biology, genetics, and medicine, because the word *translation* means *the process in which ribosomes in the cytoplasm or ER synthesize proteins after the process of transcription of DNA to RNA in the cell's nucleus*. PM is aimed at tailoring treatment for an individual patient and choosing and devising medicines adequate to this or that patient and this fact is reflected in the following names of this medical field *customized drug therapy* and *rational drug selection*. PM sometimes is named *omics-based medicine*. The Greek suffix *-omics*, meaning “*whole, entire*”, is frequently used “to describe something big, and refers to a field of study in life sciences that focuses on large-scale data/information to understand life” [21]. Starting as the suffix of genomics, it refers to nearly 100 technologies, all of which are relevant to development of PM. They include *pharmacogenomics, pharmaco proteomics, pharmacometabolomics, metabolomics, proteomics* and many others. Nowadays the active use of this suffix allows scientists to demonstrate their involvement in a new and exciting field of science which deals with a bulk of sophisticated data [5, p. 48-49]. Medical institutions and research centers develop “omics platforms, technologies for processing clinical samples, bioinformatics for data interpretation/results analysis” [14, p. 19]. They all are meant to cover the most important medical issues in their entirety and in their interrelation and thus to facilitate the development of PM for the benefit of patients. The omnitude of the discussed medical field is reflected in a broader term *integrated healthcare*. The role of information and information technology is revealed in the name *information-based medicine*, which is also used to designate PM.

PM being a new and evolving science, no dictionaries of its terms have been found. There exist various glossaries of terms among which we can mention “Terminology for Personalized Medicine: a systematic

collection” [17], “Toward Precision Medicine: Building a Knowledge Network for Biomedical Research and a New Taxonomy of Disease” [18], and some glossaries of words which can be attributed to PM and found in specialized articles and monographs devoted to PM (“Health Promotion Glossary” [13], “A Glossary of Modern Healthcare Economics” [20], “Healthcare Benefit and Medical quality Glossary” [11], “Pharmacogenomics and Personalized Medicine Glossary and Taxonomy” [8] and some others. Some terms can be found in monographs written by K.K. Jain, P. Cullis, G. Grech and I. Grossman, B. V. Beers, S. Sterckx, D. Dickenson etc.

PM is a rapidly growing science and the like is its terminology. The latter comes out from the interaction of several self-consistent and sometimes even remote term systems like biology, genetics, pharmacology, oncology, neurology, cardiology on the one hand, and insurance, economics, law, ethics on the other hand. Borrowed lexical units undergo some semantic changes for they can respond to the needs of this new developing science. For example, insurance term **copayment** is also used in PM discourse, it means *the set amount you may be required to pay each time for a medical service or product (for example, every time you visit your doctor, you might pay \$15 while your plan pays the rest)*. Being included into the terminology of PM some common words can change their meaning, e.g. **appropriateness** (*in Health Care*) means *the right care, provided by the right providers, to the right patient, in the right place, at the right time, resulting in optimal quality care*.

The sphere of concepts of PM is a part of professional spheres of concepts, which can be structured as a frame. There are two approaches to the interpretation of this notion. The first one views a frame as a knowledge structure. Every linguistic unit represents a definite linguistic structure and linguistic meanings fail to render the full continuum of world knowledge, part of them is hidden and preserved in the memory of a person in the form of cognitive models, scripts, schemes, and propositions. Ph. N. Johnson-Laird distinguished between images, propositions, mental models, frames, spatial models, kinematic models, etc. [2, p. 79]. The second approach looks upon a frame as knowledge representation structure, which has a core which is surrounded by slots [2, p. 79].

The language of PM can be considered as a peculiar cognitive and communicative world. The whole complex of notions of PM is combined into a macroframe, which consists of subframes represented by slots combined in a logical and organized way. The frames correspond with the main sections of PM.

The macroframe of PM as a structural and logical system is represented by two subframes combining both medical and social frames which demonstrate various degree of association. Medical subframe encapsulates the frames of DISEASE, DIAGNOSTICS, TREATMENT, and PREVENTION. Mentioned frames presuppose the frame SIGN. We lay emphasis to the idea of *sign*, but not the one of *symptom* because PM centers on the objective manifestations of a disease which can be revealed by laboratory investigations. P. Cullis says that PM “is driven by the conviction that signals of disease are apparent well before the disease appears (at which point it may be late). We simply need to recognize what those signals are” [9, p. 4]. And these signals can be revealed in the laboratory setting by means of specific investigations. The subframe of social notions includes TECHNOLOGY, ETHICS and SOCIAL SCIENCES, ECONOMICS, LAW whose terminologies tend to serve processes in PM. Each subframe consists of concepts which are verbalized by the terms representing the main notions of PM.

PM is aimed at diagnosing, treatment and preventing diseases which are considered the number one causes of death globally [7] and the ones being the greatest economic burden. The unchallenged leadership is maintained by all types of cancer, neurological disorders (epilepsy, multiple sclerosis, psychotic disorders), cardiovascular disorders (myocardial infarction, sudden cardiac death, cholesterol metabolism, hypertension, hyperlipidemia), some viral and infectious diseases (HIV, hepatitis B and C, malaria, tuberculosis), rheumatoid arthritis, some types of skin diseases. PM is also applicable to treatment of asthma and cystic fibrosis, pain management, as well as smoking cessation, postoperative and organ transplantation rehabilitation. Terms which serve the corresponding medical fields penetrate into the terminology of PM.

PM refers to the designing of medical treatment based on individual characteristics of each patient i.e. it is the process of tailoring treatment for each patient. PM means that “there are as many diseases

as there are people. Diseases could still be bundled together in clusters that display similarities, but the idea of common disease labels would be obsolete” [16]. PM is driven by the conviction that every ailment has a cause at the molecular level and that once you understand the cause of your disorder, an appropriate molecular-level treatment can be devised that will work for you [9, p. 3]. Modern technologies can only analyze one genome at a time. Proponents of PM are laboring to devise methods for obtaining sequence information from thousands of genomes simultaneously [14, p. 19].

The progress in molecular biology and genetics has contributed to the development of PM and that is why their terminologies comprise considerable part of PM. They verbalize the concepts of DIAGNOSTICS and TREATMENT. The main nouns which form the concepts of the frame DIAGNOSTICS include *gene, genome, genetics, genomics, phenotype, biomarker, profile* and more common terms as *diagnostics, detection, test, testing* (e.g. ***gene detection technique, molecular-based diagnostics***). The most common adjectives which designate them are *molecular, genetic, genomic* (e.g. ***molecular phenotype/biomarkers, genetic testing, genomic profile, single molecular biomarker***).

PM is studying genetic and genomic structure of a human being in order to identify certain genes responsible for the development of a disease and to develop specific drugs which would be suitable for a definite person, with a definite molecular and genetic structure. The author of the term PM states that “advances in genetics will also help in understanding drug action pathway, identification of new targets, target validation, and in silico screening” [14, p. 20]. Thus the aim of PM is to create drugs which are beneficial for a definite person because differences in genetic factors may influence person’s response to medication. Recognition of this fact lead to the development of ***pharmacogenetics*** (a term recognized in pharmacology which concerns the study of influence genetic factors on response to drugs) and later to ***pharmacogenomics*** (the application of genomics (variations of DNA as well as RNA) to drug discovery and development) and ***pharmacoproteomics*** (the application of proteomics to drug discovery and development) [14, p. 16]. Another approach to PM is “to comprehensively collect drug response profiles in patients following drug approval and widespread use in disease populations” [19, p. 17].

This fact states the interrelation between genetics and pharmacology. The terminology of pharmacology is an integral part of these divisions of PM. Interrelation between treatment and pharmacology is reflected by the common pharmacological terms like *drug*, *therapeutics*, *drug efficacy*, etc. Their meaning specializes by adjectives which emphasize different aspects of notions, e.g. *pharmacomolecular therapeutics*, *tailored drug*.

Technology is growing rapidly and pervades PM. Technological developments in the fields of information and communication create the need for new ways of communication that did not previously exist; and the vocabularies of these languages require constant updating [6, p. 4]. In this respect the frame TECHNOLOGY is acquiring importance.

According to “Merriam Webster’s Collegiate Dictionary” the term *technology* has several meanings: “1) the *practical application of knowledge esp. in a particular area*, 2) *a capability given by the practical application of knowledge*, 3) *a manner of accomplishing a task esp. using technical processes, methods, or knowledge*, 4) *the specialized aspects of a particular field of endeavour*” [15, p. 1283]. The frame TECHNOLOGY is represented by the following concepts: “methods”, “apparatuses”, “informatics”. Terms designate parts of machines, software systems, types of databases, methods of information processing, etc. Peter Cullis attaches the considerable importance to modern technology and computers. He writes “without computers the notion of molecular medicine could not exist”. Computers are used at every step of the way, from controlling the instrumentation that is used to decipher the DNA, for example, to storing the immense amounts of data that is obtained from molecular-level analyses of DNA, proteins, and other biological molecules, to analyzing all this data so that it can be used for the benefit of a patient [9, p. 20]. E.g. *cloud computing* – *style of computing in which dynamically scalable and often virtualized resources (applications) are provided as a service over the Internet*; *encryption* – *a technique of scrambling transmitted data, using special encryption software, so that only a party with the ability to unscramble the message has access to it*.

The frame ETHICS and SOCIAL SCIENCES is represented by the following concepts: “ethics”, “medical culture”, “statistics”. PM is based on genetic investigations and pharmacogenetics and that is why ethical and medical culture aspects gain in special importance. Genetic

information and genetic approach to disease affect people individually, within their families and communities, and in their social and working lives. This information can lead to stigmatization and discrimination of different populations on various grounds. The following terms can be given as examples: **close call** – *the event did not reach the patient because of timely intervention or good fortune (the term is often equated to a near miss or near hit)*, **patient safety** – *the reduction of risk of unnecessary harm associated with healthcare to an acceptable minimum*, **acceptable minimum** refers to the collective notions of given current knowledge, resources available and the context in which care was delivered weighed, against the risk of non-treatment or other treatment.

Terminology of Statistics allows to represent the details about findings, collection, filing, displaying, investigation, interpretation and presentation of the data obtained by PM. E.g. **covered lives** – *the number of distinct individuals counted as enrolled members of a health plan or program*, **cross-sectional data** – *observations on various persons or events collected at a single point in time*, **enrollee** – *an individual who qualifies for health benefits and has taken action to register for or make a request for participation in the plan*.

Ethical implications are closely connected with health law, which protects patient rights, regulate the collection and use of health information, regulates the operations of medical institutions, regulate the safety and efficacy of medicines and medical devices, etc. [12]. The frame LAW combines such terms as **health care fraud** –*when a health plan is billed for services or supplies never received by an enrollee in the plan*.

Investigations performed in PM are time-consuming and high-cost for both patients and PM providers. Financial aspects of PM are important for two reasons: 1) pharmaceutical companies would like to know if it is affordable, 2) healthcare providers would like to know if it is affordable. The cost of different projects amounts to 100,000\$ or 350,000\$. However the cost/effectiveness of pharmacogenetic testing has not been studied extensively [14, p. 383-384, p. 389]. In 1960-s a new branch *health economics* appeared. That is why terms dealing with economics and commerce are used by PM to describe corresponding issues, they represent the frame ECONOMICS. E.g. **benchmarking** – *the process of comparing an organization's costs and performance*

against some index of costs and performance across the industry in which the organization competes, **outsourcing** – an attempt to cut costs by sending components of work outside of an organization.

Structurally the terms functioning in PM are diverse; they include both one-word lexical units and word combinations. Terms of PM are formed by means of four main means of word-building: morphological, syntactical, morphological-syntactic, and lexico-semantic.

Morphological methods of word-building include affixation and compounding. The most productive derivational elements are -omics, -ic, -ed, -ing, -ar, -er, -ory, pre-, pro-, co-, nano-, multi-, e.g. *individualized dosing*, *oncogenomics*, *molecular screening*, *proteomic biomarker*, *participatory medicine*, *proactive*, *pre-treatment genotyping*, *prognostic assays*, *drug-diagnostic co-development*, *nanotheranostics*, *multiparameter*.

There are also some terms derived from different languages, such terms are called hybrids. The adjectives *drugable* and *non-drugable* consist of the English root *drug-* and “the suffix that is derived from the Latin *-abilis*” [1, p. 106], Latin prefix *non-*. They are used in the terms ***drugable targets*** (*those that can be successfully approached with conventional small-molecule, protein, or antibody therapeutic interventions*), and ***non-drugable targets*** (*they will likely require unconventional approaches, including antisense or gene therapy*) [19, p. 11-12].

Compounding is one of the oldest methods of word-formation. The main elements which are used in this process are of Greek and Latin origin. They are called term-elements and are the main building blocks of medical terminology. E.g. *theranostics* and *theragnostics* form the combination of two terms *therapy* + *diagnostics*, *nanotheranostics* is composed of *nano* + *therapy* + *diagnostics*. Compound terms consist of two, or rarely more, simple or derived stems which are combined into a lexical unit [1, p. 78]. Such terms as *oncogenomics*, *theranostics* are called synthetic compounds because they can be transformed into a syntactically correct word combination. Others, like *patient-centered* are asyntactic because they can't be reduced in a grammatically correct way e.g. *to center on patients*.

Syntactical method of word-formation is the most productive. Terms consisting of several words prevail due to the fact that relation between such a term and a designated notion creates continuity of

phrase structure making it the equivalent to a one-word term [3, p. 10]. The following types of terminological word combinations are revealed in the vocabulary of PM: 1) word combinations consisting of two words, e.g. *pharmacogenetic guidance, transcriptomic screening*; 2) word combinations consisting of three words, e.g. *proteomic pattern diagnostics, single molecular biomarkers*; 3) word combinations consisting of four words, e.g. *molecular genetic screening tools*. Increase in the number of words can be explained by the desire to reveal the essence of the term the most precisely by adding words which specify the meaning, e.g. *genomic-based diagnostic test*.

It sometimes occurs that word combinations consist of two compound words, e.g. *drug-diagnostic co-development*. Arnold I.V. points out elements of a phrase united by their attributive function become further united phonetically by stress and graphically by a hyphen. [1, p. 122]. E.g. *direct-to-consumer genomics, direct –to-consumer genetic information services*.

Morphological-syntactical method is represented by the process of shortening of extended terminological word combinations, i.e. the process of abbreviation. Abbreviated terms of PM vary in their graphic design. They may consist of capital letters, both capital and lower-case letters, occasionally they may contain numbers and a hyphen, e.g. *RX-cDx*. PM is sometimes called *P4 medicine* that means *personalized, predictive, preventive, participatory medicine*. Abbreviations may be also represented by acronyms, i.e. words which can be read as ordinary English words and sounds like one word [1, p. 142], e.g. **COBRA** – *Consolidated Omnibus Budget Reconciliation Act of 1986*. Specialists perceive abbreviated medical terms as a specialized cognitive complex of a professional linguistic world view. An abbreviation can be treated as a meaningful linguistic unit if it acquires characteristics similar to the ones of a single word. These characteristics include proper lexical meaning, derivational potential, and self-sufficiency [4, p. 78].

Metaphorization is a lexico- semantic method of word formation. Metaphor is a kind of modeling some abstract notions in the image and likeness of a specific term, it is a kind of figurative reinterpretation of language units [4, p. 83]. Metaphorical transfer is based on the comparison with different objects and notions.

The following terms are metaphorical: 1) *coverage gap ("donut hole")* – *when your Medicare prescription drug plan temporarily stops*

paying your prescription costs once you reach the spending level in your Medicare Part D drug coverage. Once you enter the donut hole coverage gap, you get a 47.5 percent discount on covered brand-name drugs and pay 72 percent of the plan's cost for covered generic drugs until you reach the end of the coverage gap; 2) **Delphi Technique/Method** (the name Delphi derives from the Oracle of Delphi) – *is based on the assumption that group judgments are more valid than individual judgments (The Delphi method was developed at the beginning of the Cold War to forecast the impact of technology on warfare);* 3) **blockbuster drugs** *are those that are typically used to treat chronic or long-term medical problems, as opposed to acute or short-term conditions (They also generate at least \$1 billion in revenue a year for the pharmaceutical companies that produce them.);* 4) **Obamacare** – *the Affordable Care Act, also known as the health care law, passed in March 2010. It puts in place strong consumer protections, provides new coverage options and has tools to help you make informed choices about your health coverage*

The structure of PM and the diversity of its terminology represent its knowledge as an ideal mental image enabling to store and transfer special information. Its terminology is defined in relation to various fields from which it chooses specific concepts, notions, and terms, then elaborates them adjusting to its own needs. The variety of concepts evidences that vocabulary of PM is not just a set of words and word combinations verbalizing important phenomena, it is constantly evolving terminology which is taking the form of a terminological system.

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PSYCHOLINGUISTIC BENEFITS OF ASYNCHRONOUS APPROACH TO DISTANT LEARNING AMID HEIGHTENED SOCIAL ANXIETY AND ISOLATION. A GESTALT-DIALECTICAL PERSPECTIVE

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Abstract. *The ongoing COVID-19 epidemic has exerted numerous effects on private and professional lives alike. In particular, sociological and psychological studies show detrimental effects in terms of anxiety. With respect to teaching English, it is taking place almost exclusively in online spaces, which may also cause anxiety or*