Approaches to improving the coordination of planning research studies and assessing expected research findings

Abstract. Background. Historical analysis of the medical science development around the world proves that its results have always been the driving force for progress, and this process is constantly evolving as research itself. Rapid information technologies development affects priority areas for medical research; advances in biotechnologies, nanotechnologies, molecular genetics, bioinformatics, system biology, nanobiotechnology, proteomics, postgenomic studies; cell technologies lead to further development of lines of research. The use of digital health as a system of information and communication technologies, including blockchain technology, allows to securely store and detail medical information, based on the evidence, effectively influence the quality of medical prescriptions, as well as the quality of care delivery in general. The latest technology in medicine has become 3D-printing, which enabled printing implants, prostheses, parts of organs and tissues. Three-dimensional models of human organs, as well as some artificial tissues got by 3D printing, are used for drug research and testing. The dynamic development of medical science in the world, changes in lines of research in favor of biomedical research and biotechnology, genetic engineering, personalized high-tech medicine prompts domestic researchers to search for new areas, the expected of results of which would be innovative in the European countries, as well as around the world. It is urgent to find ways to effectively coordinate research planning, documents (requests) assessment planning and the implementation effectiveness. The purpose of our study is to analyze the implementation of the recognized prior areas in the world of science, to substantiate approaches for improvement of planning, taking into account certain priorities, national features and the current situation. Materials and methods. Methods of semantic evaluation of scientific documents, results of PhD theses and research works, methods of bibliosemantic, structural and logical content analysis, descriptive-analytical modeling were used during the research. Basic reaserches planning and implementation materials in the National Academy of Medical sciences of Ukraine of Ukraine categorized by the priority areas for the national medical science for the last five years, own research endpoints concerning planning and implementation materials evaluation have been used. Results. The article gives an overview of the implemented prior lines for the development of domestic fundamental medical research, in particular in terms of their scientific novelty, theoretical and practical importance, substantiation of the further search in the chosen area. The expediency of applying the expert approach to the evaluation of planning materials and the implementation of scientific research in the world practice with the introduction of scientifically sound evaluation indicators is shown. Conclusions. Developing prior areas for domestic basic research, as well as ensuring effective planning, assessing requests for research funding and evaluating research endpoints, in view of the best world practice, is required today. Ensuring the introduction of modern effective mechanisms for coordinating the research implementation in the domestic medical industry will allow further worthy continuation, development and implementation of fundamental medical researches, taking into account unique demographic, socio-hygienic and socio-economic factors that have a complex impact on the formation of nation’s health.

Keywords: basic research; effective coordination of research planning and implementation; indicators of the research effectiveness evaluation
Introduction

Modern science, as an area of human activity, aims at obtaining and systematizing objective knowledge, new scientific concepts and visions about shaping the reality of human existence. The experience of developed countries of the world convincingly proves the effectiveness of investments in the development of modern research priority areas.

During the years of national healthcare reforming, the vectors and emphasis of the further development of the medical sector as a whole have been changing. Current state of affairs requires continued work to ensure sound science planning, in line with the country’s priorities, with the introduction of a mechanism for effective planning for those fundamental and applied studies, the results of which will be of paramount importance for the development of medical science for the future. Thus, the researches endpoints concerning implementation of innovations in nuclear medicine, photodynamic, gravity, laser-magnetic therapy, electromagnetic hyperthermia, bioinformatics, system biology, nanobiotechnology, proteomics, post-genome technologies are being actively published. Breakthroughs and discoveries in the field of quantum physics of cell functioning are possible. Modern fundamental research analysis in the world has shown that there are changes in priorities for the study of the genome, the creation of an “artificial immune system”; “instant ways pain relieve”; “bionic implants”; regenerative medicine and organ transplantation; aging slowing or stopping; gene therapy; molecular and genetic diagnostics; cloning; creation of “personalized medication”, etc. [2, 4, 12–16]. Their results are actively applied in practice, in particular:

- cell and tissue engineering – a field of biological science that, in the next 5-10 years, can provide clinically acceptable approaches to the restoration of vital tissues and organs: the heart muscle, the liver, the insulin-producing pancreatic cells, the nerve cells, and others [6, 10, 11];
- microchipping – a tool for gene expression research, which is already successfully used to investigate the profile of gene expression, identification of pathogens in the biomaterial, genotyping and resequencing [2, 4, 6];
- nanotechnologies, which allow to determine low concentrations of biological substances in a cheaper, faster and more specific way, as well as to bring modern medical science closer to the development of new approaches of the treatment of cancer and neurodegenerative diseases [3, 12 - 14];
- proteomics is an applied science that studies proteins, the main point of its application is now considered to be the synthesis of biomarkers that can be used in pharmaceutical and diagnostic development to simplify and accelerate the diagnostics of diseases and the development of new drugs [15, 16];
- DNA sequencing is a technology that can soon decipher a patient’s genetic code and, accordingly, select personal treatment while minimizing side effects with maximum effectiveness [8, 10].

The implementation of the priorities of medical science development in Ukraine requires considerable re-equipment, refinement of the methodological base, rethinking of ideology and scientific bases of problems of theoretical and clinical medicine. The above mentioned also implies the improvement of coordination of research works planning with the purpose of increase of their efficiency, which as a whole convinces us of the relevance of the problem raised by us.

The purpose of our study was to analyze the implementation of the recognized key directions of the development of science, to substantiate approaches for improvement of their planning for the future, taking into account the defined priorities, national features and the current situation.

Materials and methods

During the research the materials of planning and execution of basic scientific studies in the National Academy of Medical Sciences of Ukraine on the key directions of the development of the national medical science for the last five years were used, as well as the results of our own scientific studies on the evaluation of planning materials and execution of research works. Methods of semantic evaluation of scientific documents, results of PhD studies, methods of biblio-semantic, structural and logical content analysis, descriptive-analytical modeling were applied.

Results and discussion

According to the Strategy of the National Academy of Medical Sciences of Ukraine, fundamental research works have always been and remain its priority. In particular, in the last five years, fundamental research has been devoted to: the development of technologies for the production and use of stem cells for the correction of malfunctions of the human body; development of new technologies for treatment and prevention of viral infections, endocrine diseases; creation of new technologies for obtaining cellular prepara- tions with improved characteristics; development of means of premature aging prevention; development of new technologies for usage of nanoparticles for treatment and prevention; preserving the labour and reproductive potential of the nation; study of the long-term genome abnormalities after the Chernobyl disaster; study of new mechanisms of development of major non-communicable diseases; synthesis of new pharmacological drugs and others. Modern high-specific methods of diagnostics and treatment of rare hereditary diseases are being developed, an algorithm of using biochemical and molecular-genetic research methods for selective screening of hereditary metabolic diseases, further timely appointment of specific treatment are being developed.

Due to the introduction of modern molecular genetic studies, priority data have been obtained on the pathogenesis of major forms of severe cancer and non-tumor pathology, which extend the possibilities of effective diagnostics and personalized treatment. Complex studies have been conducted to determine the role of messenger systems (at the intracellular and nuclear levels) in mediating regulatory influences in tumor cells, to search for new diagnostic tumor markers [19]. Compatible molecular genetic studies have been conducted with the leading US scientific institutions that have shown that radiogenic papillary thyroid carcinomas are more characteristic of chromosomal rearrangements than point mutations.
The results of basic scientific studies significantly expand the current understanding of the effectiveness of cellular and tissue preparations for the treatment of complications of diabetes, the first encouraging results of the innovative use of stem cells in the treatment of diabetes and its complications, in particular diabetes syndrome, have been obtained [18].

The effectiveness of human umbilical cord mesenchymal stem cells with enhanced expression of human IL10 and SDF1 genes for the correction of experimental pathologies of different genesis is being investigated, as well as the role of cellular and endocrine factors in the realization of neuroprotective properties of stem cells in the peripheral cells. The search for immunological markers of diabetes mellitus is under way, and the detection of DAAT has made possible the minimally-invasive intravital detection of the autoimmune process in the pancreas of a person, the latter created the conditions for the prediction of probable development of insulin-dependent Type 1 Diabetes Mellitus in a still healthy person.

For the first time in Ukraine, based on the study of gene polymorphisms that encode cytokines, sex hormone receptors, proteins belonging to various vital metabolic and signaling pathways, in particular cytokines, sex hormone receptors, blood coagulation factors, folate metabolism, and proteins that support functioning of vascular endothelium, which has led to the development of new approaches to the diagnostics, prevention and treatment of pregnancy miscarriage [23].

Priority data were obtained regarding long-term radiation-induced changes in gene expression and polymorphism, genome instability, and cellular senescence in chronic somatic pathology in persons chronically exposed to a wide range of doses. BCL2, SERPINB9, CDKN2A, STAT3, TP53, MCF2L gene changes have been established [20]. Methods of molecular epidemiology have been introduced in patients with radiation-induced leukemia [21].

The neuropsychobiological mechanisms of affective and cognitive disorders associated with irradiation in the Chernobyl Catastrophe were investigated taking into account the polymorphism of genes; the association of long-term radiation-induced changes in gene expression with non-tumor effects in the Chernobyl accident consequences liquidation participants was studied; the role of BCR/ABL gene mutations, chromosomal, molecular genetic disorders as well as the immunogenetic parameters in developing approaches to optimize targeted therapy for patients with chronic myeloid leukemia in the remote period after the Chernobyl accident, and the role of molecular and genetic markers of somatic cells for patients with chronic lymphoproliferative tumors was determined. Gender peculiarities of the most common diseases of the circulatory system in the Chernobyl accident consequences liquidation participants were established taking into account structural and functional changes of the myocardium, polymorphism rs 966221 of the PDE4D gene and the effect of radiation factor.

To summarize the above mentioned, I would like to emphasize that the results of the fundamental studies illustrate new mechanisms of disorders development, allow developing modern effective methods of their diagnostics and treatment, and therefore are in demand in the state as a whole. Publications analysis shows that Ukrainian medical science is capable of obtaining priority results with the support of the state. Being able to look at the planning of basic research in medicine, it is impossible to ignore the tendencies towards funding reduction, which leads to the collapse of a number of areas of fundamental studies. A permanent funding deficit inevitably leads to the degradation of the material and technical means, the loss of research staff.

Planning fundamental research works is currently taking place in the conditions of inconsistency of the capabilities of research institutions with the requirements of current directions of the world medical science development. Scientists
of the National Academy of Medical Sciences of Ukraine cannot carry out fundamental research studies at the present methodical level: the material means are outdated, there is a shortage of reagents, consumables, new modern equipment. Under the current circumstances, it is necessary to concentrate resources on the priority and most promising areas of fundamental research studies that meet the global trends in the development of medical science. Creation of a unified system of research & relevance - reflects the correspondence of the planned theme to the modern requirements of the development of medical science and practice in Ukraine and in the world;

- novelty - reflects the probability of acquiring new knowledge (new scientific information, technologies, products, etc.) as the expected results. In this case, the highest estimate of the novelty of the expected results may be in the case when for the first time: a fundamental research is planned, the results of which will make it possible to explain and / or open up new phenomena, processes, links of pathogenesis, diagnostic criteria, etc.; scientific information is obtained, on the basis of which it will be possible to "shed light" on the undefined aspects of pathogenesis, treatment, prevention of diseases of the population of different ages, on the basis of which new scientifically proven algorithms of prevention, diagnostics, treatment, rehabilitation will be proposed;

- compliance with the current priority directions of the development strategy of medical science in the National Medical Academy of Ukraine;

- assessment of the methodological apparatus of the study - the expected informativeness of the results of the study is assessed by the presence of comparison groups, adequate controls, randomization, availability, processing and accounting of primary documentation, methods of medical statistics planned for use, their adequacy, scientific validity of the sample;

- assessment of the ability of the authors team to realize the stated purpose of the research - the assessment takes into account the experience of the head of the planned research study and the experience of the team of scientists who are co-executors of the planned research study;

- availability of material and technical means necessary for the realization of the stated purpose of the research - the expediency of the use of the claimed equipment, conformity and sufficiency of the equipment, taking into account the equipment of foreign laboratories engaged in similar research studies. The level of material and technical base for implementation of the planned research studies involves the possibility of using modern equipment, including for molecular research, which will allow to compare the results to those obtained at similar laboratories in the world. Medium - the level of the proposed equipment allows to realize the goals and objectives of the research study. Low - the stated level of the material and technical means does not allow to provide a high level of realization of the research goals and objectives;

- competitiveness - the assessment of the competitiveness of the expected results involves independent experts’ opinions;

- availability of previous scientific research studies - the presence of previous scientific research studies convincing in the correct choice of the direction of the scientific search (availability of articles, abstracts on the research topic, availability of primary material confirming the expediency of further scientific research studies, accelerates the obtaining of scientific results;

- the medical, social and economic efficiency of the expected results is described by the authors of the project proposal, taking into account the predicted economic effect for the state due to preventing premature mortality, disability, temporary disability, etc. thanks to preserving the labor potential for the future;

- expected number of publications in journals Scopus, Web of Science, Pub Med Indexed Journals, the number of professional domestic publications, domestic/foreign patents, innovations, methodological recommendations;

- additional facts regarding the uniqueness of the planned research topic, the expediency of its financing.

The list of given indicators can be adjusted and supplemented in accordance with the existing economic conditions of the national medical science. Despite the current difficult situation, it is necessary to gradually increase the competitiveness and export opportunities for the Ukrainian medical science in the world market of scientific products and medical services. Priority should be given to the development of fundamental knowledge and innovations in the medical field.

Planning research topics should be carried out with focus on the current breakthrough trends in the development of medical science with the development of complex topics, participation of several different specialized institutions, concentration of equipment and methodological capabilities of institutions. It is necessary to develop scientific and technical entrepreneurship, to create scientific and industrial enterprises within the framework of academic institutes, with the elimination of interdepartmental barriers, to strengthen the complexisation of scientific subjects, the rational use of budget funds, and the active implementation of results in the practice of health care. Creation and transfer of new methods and technologies of diagnostics, treatment and prevention of the most common human diseases (including new medicines, medical equipment and medical devices) remains one of the most important components of the National Academy of Medical Sciences of Ukraine in the implementation of the state innovation policy in the field of health care.

Conclusions

Summarizing the above mentioned, we would like to emphasize that the results of the fundamental research, illustrate new mechanisms of disease development, their further implementation develops modern effective methods of their diagnosis and treatment, and therefore are in demand in the state as a whole. Analysis of publications shows that Ukrainian medical science is capable of obtaining priority results with the support of the state. Cooperation with the leading research centers in the US, the European Union, Japan, China and other countries is a significant factor in

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accelerating research. An important factor is the combination of publication of results in leading foreign publications with the expansion of the number of domestic publications that are referenced in biomedical databases - PubMed, GeneBank and others.

For the effective development of the fundamental direction in academic medical science, it is necessary to have adequate material and technical, human resources at the level of similar scientific institutions, scientific bases, laboratories of the world, which will allow further worthy continuation, development and realization of fundamental medical scientific directions taking into account unique demographic, social-hygienic and socio-economic factors that have a complex impact on the formation of the health of the nation.

Justifying and creating a list of indicators for the effectiveness of planning and implementation of research works need to be discussed, their introduction will help to optimize the coordination of fundamental medical science in Ukraine. In the current circumstances, it is necessary to concentrate resources on the priority and most promising areas of basic research that meet the global trends in the development of medical science.

Creation of a unified system of scientific and information planning of research and implementation of research results is actual taking into account changes of state policy, both in general and in the field of health care in particular, with emphasis on those "social problems", which regardless of changes in political elites, will be given priority in terms of long-term planning for scientific study, as today's scientific potential is the result of strategic plans that were implemented to shape it 20 years ago.

**Conflicts of interests.** Authors declare the absence of any conflicts of interests and their own financial interest that might be construed to influence the results or interpretation of their manuscript.

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Резюме. Розглядається вплив цикли відцентрового дроблю, який забезпечує формування відтінків, на випадкове формування нормальній та злочинної тканини. Встановлено, що вплив цикли відцентрового дроблю, який забезпечує формування відтінків, на випадкове формування нормальній та злочинної тканини. Встановлено, що вплив цикли відцентрового дроблю, який забезпечує формування відтінків, на випадкове формування нормальній та злочинної тканини. Встановлено, що вплив цикли відцентрового дроблю, який забезпечує формування відтінків, на випадкове формування нормальній та злочинної тканини. Встановлено, що вплив цикли відцентрового дроблю, який забезпечує формування відтінків, на випадкове формування нормальній та злочинної тканини. Встановлено, що вплив цикли відцентрового дроблю, який забезпечує формування відтінків, на випадкове формування норм
Подходы к совершенствованию координации планирования научной тематики и оценки ожидаемых результатов научных исследований

Резюме. Актуальность. Исторический анализ формирования и развития медицинской науки в мире убеждает, что ее результаты всегда становились двигательной силой прогресса, и этот процесс постоянно претерпевает изменения, как и сам научный поиск. Время стремительного развития информационных технологий влияет на особенности формирования направлений научных исследований, толчком для совершенствования которых стал: развитие биотехнологий, нанотехнологий, молекулярной генетики; достижения в области биоинформатики, системной биологии; нанобиотехнологий; протеомики; постгеномные исследования; клеточные технологии. Использование цифрового здравоохранения (Digital Health) как системы информационных и коммуникационных технологий, в частности, технологии блокчейн, позволяет надежно сохранить, детализировать медицинскую информацию, на основе доказательных исследований эффективно влиять на качество медицинских назначений и качество оказания медицинской помощи в целом. Инновационной технологией в медицине стал 3D-биопринтинг, с использованием которого теперь печатают импланты, протезы, части органов и ткани. Трехмерные модели человеческих органов, а также некоторые искусственные ткани, полученные путем 3D-принтера, используют для исследований и тестирования лекарств. Динамичность развития медицинской науки в мире, смена приоритетов в пользу биомедицинских исследований и биотехнологий, генной инженерии, персонализированной высокотехнологичной медицины, побуждает отечественных исследователей к поиску новых направлений научных разработок, по которым ожидаемые результаты имели бы научную новизну и инновационность не только для стран Европейского региона, но и во всем мире. Актуальным остается поиск путей эффективной координации планирования научных работ, оценки документов (запросов) планирования и результативности выполнения запланированного. Цель нашего исследования стала анализ реализации признанных в мире приоритетных направлений развития науки, обоснования подходов к усовершенствованию их планирования на будущее с учетом определенных приоритетов, отечественных особенностей и реалий. Материалы и методы. В ходе исследования были использованы методы семантического оценивания научных документов, результатов диссертационных и научно-исследовательских работ, методы библиометрического, структурного и логического анализа контента, описательно-аналитического моделирования. Использованы материалы планирования и выполнения фундаментальных научных исследований в НАМН Украины по приоритетным направлениям развития отечественной медицинской науки за последние пять лет, результаты собственных научных исследований, посвященных оценке материалов планирования и выполнения научно-исследовательских работ. Результаты. В статье приведен обзор реализованных приоритетов развития отечественных фундаментальных медицинских научных исследований, особенно в части их научной новизны, теоретического и практического значения, обоснована целесообразность продолжения современного научного поиска в этом направлении. Показана целесообразность применения экспертного подхода к оценке материалов планирования и выполнения научных исследований в мировой практике с внедрением научно-обоснованных индикаторов оценки. Выводы. Развитие приоритетных направлений отечественных фундаментальных научных исследований, как и обеспечение надлежащего эффективного планирования, с оценкой запросов на их финансирование и результатов выполнения научных исследований с учетом лучшего мирового опыта, является требованием нынешнего времени. Обеспечение внедрения современных эффективных механизмов координации выполнения научных работ в отечественной медицинской отрасли даст возможность дальнейшего достойного продолжения, развития и реализации фундаментальных медицинских научных направлений с учетом уникальных демографических, социально-гигиенических и социально-экономических факторов, которые имеют комплексное влияние на формирование здоровья нации. Ключевые слова: фундаментальные научные исследования; эффективная координация планирования и выполнения научной тематики; индикаторы оценки эффективности выполнения научных исследований