POZNAN UNVERSITY OF MEDICAL SCIENCES

Contract No. SHIP-2.3/CS-02

Consulting services on modernization of education system in medicine

Strategic partnership for modernization of academic programs including the “Oncology: oncological laboratory diagnostics” and ”Clinical pharmacology” disciplines.

FINAL REPORT

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Executive Summary

The project has been realized to the order of the Republic of the Kazakhstan Ministry of Health, and its general aim was to modernize educational, scientific and organizational activities of the West Kazakhstan Marat Ospanov Medical University (WKMOMU; earlier WKSMU – West Kazakhstan State Medical University). The objective of this assignment was to provide technical and methodological assistance in strengthening the capacity of the WKMOMU in modernization of the system of health professionals' education, including specialists in oncological laboratory diagnostics and clinical pharmacologists.

The project began on June 1st, 2019, and finished on March 31st, 2021. In the initial detailed schedule of the project, activities were planned both at WKMOMU and at PUMS. However, the pandemic status forced changes in the program and schedule. Therefore, from March 2020, all activities were carried out online on Skype or Teams platforms. Finally, fifty-nine key-experts and nine non key-experts from PUMS were involved. All materials from online training sessions held in real-time were passed to all of the participants after each lecture or workshop. The materials covering several hundred pdf files are also available at PUMS. Besides, e-learning courses and materials were passed to WKMOMU staff as SCORM packages to be used on the WKMOMU Moodle platform.

The project was divided into two main parts, five tasks and eighteen subtasks.

Part 1: "Improvement of the current system of health professionals' education of the WKSMU" (WKMOMU), including:

- task 1A. "Improving educational process of undergraduate medical education";
- task 1B. "Building the capacity of academic staff and employees of the WKSMU";
- task 1.C "Development of institutional research capacity of the WKSMU".

and part 2: "Improvement of educational process and educational programs for the Clinical pharmacology (task 2A) and Oncology: oncological laboratory diagnostics (task 2B) disciplines".

The outcomes of the project are:

- several educational curricula to be implemented at WKMOMU
- several recommendations for the improvement of WKMOMU's organizational activities
- established laboratory and recommendation for the scientific laboratory functioning
- recommendation for the improvement of PhD studies and postdoctoral research activity
- several dozen of e-learning courses on medical disciplines
- hundreds of lectures and workshops on medical disciplines and research issues
- several scientific projects and projects' reviews
- three PhD students realizing their projects at WKMOMU with a supervision of PUMS experts, and one PhD candidate studying at PUMS.

Table Key performance indicators (KPI) of the project

№	KPI	expected	achieved
1	Specific weight of faculty staff trained on the Model of Competencies of the WKSMU	20%	20%
2	Number of articles submitted to international peer-reviewed journals	10	22 Including*: published – 9 accepted – 1 submitted – 12
3	Number of any researches (projects) in which both Universities are involved	3	9
4	Number of faculty staff trained as part of academic mobility program (research and teaching skills upgrading courses, capacity building cycles), both in the Client's and Consultant's country, according to the detailed schedule, see Appendix A1	At least 15	170
5	Number of faculty staff trained in online programs	30	100
6	Number of PhD candidates initiated to be trained jointly with the partnering University (initiated cooperation with co-promoter from PUMS)	3	4

* as for 31st March 2021

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Prof. Andrzej Tykarski

RECTOR

TASK 1

"Improvement of the current system of health professionals' education at the WKSMU (currently WKMOMU)"

TASK 1A

"Improving educational process of undergraduate medical education"

SUBTASK 1A1

" Development of the Improvement Plan for the undergraduate curricula of the medical education"

Task Leader:	Prof. Jacek Wysocki
Subtask Leader:	Assoc. Prof. Ewa Wysocka
Key-experts:	Prof. Jacek Wysocki
	Assoc. Prof. Anna Mania
	Assoc. Prof. Ewa Wysocka
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	(1) The plan for improvement of undergraduate programs of medical education at the WKSMU (currently WKMOMU).

1.THE ANALYSIS OF WKMOMU DOCUMENTS

In Phase 1 a list of documents necessary for the assessment of curriculum was drafted. The documents were sent to WKMOMU in August 2019. PUMS received several documents for further analysis including an explanation regarding the structure of the curriculum at the WKMOMU. In the subsequent steps, PUMS experts received some detailed syllabi, such as the introduction to the profession, biomedicine, histology, physiology, internal diseases, microbiology and immunology, propedeutics of children's diseases, pediatric surgery, sexually transmitted disease and urology. All these documents constitutes a basis for the detailed analysis of the educational content not only in comparison to the Polish curriculum, but also to the final shape of the graduate and the required knowledge and skills.

In the next step, PUMS experts were assigned to the task and analyzed the obtained documents, as well as specified all missing documents. Following a primary analysis of the current curriculum 5+2 years of undergraduate training in the period 11.11. – 15.11. 20219, PUMS experts, i.e. Anna Mania and Ewa Wysocka attended a meeting with the Deans and the academic staff in Aktobe in order to explain the details of the curriculum and to clarify all doubts, as well as to collect the missing documents. They met also with the representatives of the basic, preclinical, and clinical courses, and with the students. They discussed the specific conditions at the WKMOMU, which may have an impact on the implementation of the modernized curricula.

During the visit in Aktobe, a preliminary analysis of the two existing curricula was performed. Additionally, a discussion concerning the WKMOMU curricula and its main strengths and weaknesses was held.

2.THE COMPARISON BETWEEN THE WKMOMU MEDICAL EDUCATION CURRICULA AND THOSE CURRENTLY PRESENT AT PUMS

A detailed comparison between the WKMOMU medical education curricula and those currently present at PUMS was performed by the PUMS experts participating in the task. There are currently two ongoing curricula at the WKMOMU – 5+2 years and a 6-year long.

In order to prepare a modernized curriculum, adapted to the European standards of medical education for students at WKMOMU, current curricula were analyzed in detail in terms of the fundamental principles and learning outcomes. To prepare the matrix of the learning outcomes and the evaluation system of the quality of education, all details of the curriculum were analyzed to evaluate the medical education process, from the basic sciences to the clinical practice.

The subject content of syllabi was analyzed in relation to the subsequent years of the curriculum and the appropriate learning outcomes, knowledge, skills and competences. Moreover, the types of student evaluation and practical, as well as theoretical exams, were reviewed.

The quantity and quality of teaching hours presented for the basic, preclinical and clinical subjects were evaluated with a special emphasis on the contact classes. The PUMS experts aimed at the optimization of the proportion between contact hours and individual student work.

The educational methods presented in the syllabi and their effectiveness with regard to the subjects were assessed. The teaching base and qualifications of the academic teachers presented in the curricula were evaluated.

3. THE DEVELOPMENT OF GUIDELINES FOR THE WKMOMU CURRICULA REORGANIZATION

In the period between April – June 2020, a detailed analysis of the WKMOMU curriculum was performed and guidelines for its reorganization were developed. Firstly, the syllabus for the basic sciences during the medical studies at the WKMOMU were analyzed. The experts from PUMS encountered certain difficulties, since some syllabi (e.g. "Principles of anatomy" and "Anatomy – course 2") were sent in Russian instead of English, whereas the syllabus for "Chemistry" was sent twice with a different content.

The experts prepared guidelines for the reorganization of this part of the WKMOMU with particular emphasis on more comprehensive and larger courses with one final exam, instead of courses divided into parts with separate exams. Additionally, experts analyzed the names of particular courses which were often unclear and did not always reflect the curriculum content and the learning objectives. The proportion of hours attributed to each subject group and the number of hours devoted to the practical classes required special discussion. Some additional recommendations were addressed to improve the acquisition of the adequate practical skills of the graduates.

A detailed comment of the PUMS experts and suggestions of changes were prepared; however, further discussions with the WKMOMU leaders and academic teachers were necessary to adjust the proposed changes to the local possibilities and needs.

The on-line meeting scheduled for June was postponed to July-August due to the epidemiological situation in Kazakhstan and Poland, and with the difficulties on both parties in arranging the participation of the necessary persons.

4. THE WKMOMU FEEDBACK AND THE IMPROVEMENT PLAN DEVELOPMENT

After submitting the report dating from 29th June 2020 including general and specific recommendations concerning the curriculum "General Medicine," an on-line meeting with the WKMOMU representatives was held on 20th July 2020. The participants of the on-line discussion were PUMS key-experts Jacek Wysocki (Task 1A Leader) and Anna Mania and WKMOMU representatives: Nurgul Alekenova - the Head of Academic Work Department (the person responsible for Task 1A1), Nurgul Abenova – the Chairman of the Academic Committee «General Medicine» - the person responsible for Task 1A1, Gulnara Sultanova, Talgat Abilov - the Deans, Elnara Ismagulova – the Vice-Rector for Educational and Academic Affairs, Samat Saparbayev – the Vice-Rector for Strategic Development and International Cooperation. All the remarks were analyzed and discussed during the meeting.

Following the meeting, a detailed matrix of the learning outcomes and a working curriculum altered according to the suggestions was obtained from the WKMOMU and analyzed in detail.

After the analysis of the new documents, PUMS experts concluded that the matrix of the learning outcomes was prepared carefully according to previous suggestions and should help establish the end-point goal of the curriculum.

In the period between October – December 2020, the following documents were prepared by the PUMS experts: graduate profile, general and detailed learning outcomes in terms of knowledge, skills and competence divided into basic, preclinical, social, and clinical sciences, as well as a proposed curriculum for 12 semesters including the ECTS credits.

On the basis of the abovementioned documents, a curriculum for a 6-year long curriculum was prepared and sent to the WKMOMU representatives as a material for further discussion. Two on-line meetings were organized for the WKMOMU and PUMS experts: on December 7th and December 14th 2020. The suggested curriculum was discussed into two parts: basic sciences and clinical sciences. Certain modifications were proposed on the basis of these discussions.

A detailed analysis of the current undergraduate curriculum of the medical education, some ongoing changes in the WKMOMU, as well as a discussion with the WKMOMU representatives, revealed several important challenges for the Authorities of the WKMOMU and the Faculty of Medicine. The WKMOMU and PUMS experts agree that the additional detailed improvement plan, covering the educational standards and the development of the learning outcomes-based curriculum, is necessary. Additionally, PUMS experts could implement some extended measures between January/February 2021, in order to complete Task 1A1.

In the period between January – March 2021 the experts assigned to Task 1A.1) continued their work on the documents containing the improvement plan, design of curriculum, graduate profile, as well as the list of the learning outcomes. As mentioned in the former report, the proposed curriculum was presented to the WKMOMU authorities during two Skype meetings (7th

and 14th of December 2020). All observations of the Kazakh partners to the proposed curriculum were analyzed, and the possible solutions regarding the discrepancies between the WKMOMU expectations and the need of the EU standards implementation were discussed. The critical remarks and questions of the WKMOMU authorities were discussed again during the subsequent on-line meeting on Skype held on 22nd February 2021.

Based on the proposals of the Polish experts and the conclusions of the three on-line meetings, the final documents were prepared including:

1. The Improvement Plan
2. The suggested modified curriculum for the medical studies.
3. The WKMOMU Graduate Profile. Graduate: a medical doctor.
4. Standards and Learning Outcomes for the medical studies.

5.ATTACHED DOCUMENTS

Attachment 1A.1 I – The Improvement Plan for the undergraduate programs of the medical education at the WKMOMU.
Attachment 1A.1 II - The suggested modified program for the medical studies
Attachment 1A.1 III – The WKMOMU Graduate Profile. Graduate: a medical doctor
Attachment 1A.1 – IV - Standards and Learning Outcomes for the medical studies.

SUBTASK 1A2

" Improvement of internal policies and procedures for managing educational and research activities"

Task Leader:	Prof. Jacek Wysocki
Subtask Leader:	Prof. Anna Surdacka
Key-experts:	Prof. Jacek Wysocki
	Prof. Anna Surdacka
	Prof. Michał Nowicki
	Mgr Bożena Raducha
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	(1) The report with proposed changes in academic staff management policy and procedures.

1. THE ANALYSIS OF WKMOMU DOCUMENTS

Phase 1 covered the period between June 2019 and January 2020. Between June and August 2019, the WKMOMU staff members provided PUMS experts: Anna Surdacka, Bożena Raducha and Michał Nowicki with documents translated into English. These records pertained to the policies and procedures for managing educational and research activities at the WKMOMU, such as documents concerning academic staff, documents describing application for various positions at the WKMOMU, documents describing the principles of employment and recruitment of the academic staff members, principles of teacher's evaluation, regulations regarding the mandatory professional training of the academic staff members.

In the period between September 2019 until March 2020, PUMS experts analyzed thoroughly all the documents sent which contained a description of the recruitment and management procedures to be followed in the employment process for the research and teaching staff at the WKMOMU. On the basis of the abovementioned documents received from the West Kazakhstan Medical University in Aktobe concerning "The ways of monitoring and evaluating the workload and quality of teaching activities", some points for discussion during the Skype-meeting were drafted. The scheduled meeting was cancelled due to the COVID-19 pandemic.

2. THE EVALUATION OF THE RULES INCLUDING EMPLOYMENT, PERIODIC EVALUATION OF RESEARCH DEVELOPMENT AND PROFESSIONAL PROMOTION OF THE WKMOMU RESEARCH STAFFS AND THE DEVELOPMENT OF THE REPORT WITH PROPOSED CHANGES

The academics from Poznan University of Medical Sciences prepared modified general proposals to improve the teaching and research activity on the basis of the data and information obtained during the three meetings held with representatives of the WKMOMU (April, May, June 2020). As a result of the discussion during the on-line meetings and preceded by the analysis of the documents provided by the WKMOMU, the Polish experts outlined the main proposed changes. Initial suggestions for consideration were prepared as the subjects for discussion with the WKMOMU authorities.

The following activities were performed in the period between October and December 2020:

1. The responses of the WKMOMU representatives given to PUMS, additional queries resulting from "The preliminary recommendations in the field of improvement of internal policies and procedures of management of educational and research activities" were analyzed.
2. An on-line meeting with the WKMOMU representatives was conducted on December 7th 2020 in the scope of a detailed explanation of the answers provided (see above).
3. A detailed analysis of the current solutions at the WKMOMU in the scope of internal policies and procedures of management regarding educational and research activities was performed.

4. Becoming familiar with the state (Republic of Kazakhstan) regulations in the aforementioned area was performed.
5. The current available literature on the implementation of incentive systems was analyzed.
6. Comprehensive (final) recommendations in the scope of "Improvement of internal policies and procedures of management of educational and research activities" were prepared. These included:
    a. A change in the position types (both research and teaching) held in the WKMOMU followed by the optimization of the employment level.
    b. Methods of recruiting research staff, optimizing developmental paths in this group of employees, as well as standardizing their periodic evaluation.
    c. Parametrization of research activities.
    d. Management of research staff with particular emphasis on young researchers.
    e. Introducing a system of rewarding employees.

In the period between January 1st and March 31st 2021, a detailed evaluation of the rules including (1) employment, (2) periodic evaluation (3) of research development and (4) professional promotion of the WKMOMU research staffs was performed again.
On the basis of the recommendations for changes in the employment policy and the academic staff management procedures (presented to the WKMOMU in 2020), as well as on the WKMOMU comments, an on-line meeting was held on February 19th, 2021, the conclusions were drawn, which constitute the basis for the final report.

3.ATTACHED DOCUMENTS

Attachment 1A.2 – I: Report with the suggested changes in academic staff management policy and procedures.
Attachment 1A.2 – II: the WKMOMU comments regarding the Recommendations for changes in the employment policy and the academic staff management procedures purposed for improving the teaching and research effectiveness.
Attachment 1A.2 – III: The appendix to the Report with the suggested changes in the academic staff management policy and procedures

SUBTASK 1A3

" Development of an action plan on effective clinical training at clinical sites"

Task Leader:	Prof. Jacek Wysocki
Subtask Leader:	Assoc. Prof. Ewelina Gowin
Key-experts:	Prof. Jacek Wysocki
	Assoc. Prof. Ewelina Gowin
	Prof. Michał Nowicki
	Prof. Maciej Krawczyński
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	(1) The plan for the improvement of clinical training at selected clinical sites of the WKSMU (currently WKMOMU)

1. THE ANALYSIS OF WKMOMU DOCUMENTS

The starting point of this task was an analysis of the clinical training of students at the clinical facilities at the WKMOMU and the methods of evaluation of the quality of teaching at the year 2019. To start this analysis the WKMOMU was asked to send documents concerning the detailed curricula in several clinical specialties. The documents prepared for the task 1A.1 were used as well. On the basis of the received information, further questions were created in order to analyze the current situation in clinical training of students. All the data obtained were used to compare the clinical training at the WKMOMU and PUMS.

In the period between September 1st and December 31st, 2019, the documentation (prepared and sent by representatives of the WKMOMU) in the scope of the teaching classes plan for the medical students regarding basic sciences was analyzed. In particular, the number of teaching hours allocated to the classes, their subject-matter and the scope of knowledge, competences and skills which should result from these activities were resolved.

In September and October, the Kazakh party was asked again to supplement the above-mentioned documentation (some of the items were not delivered at all; some contained formal deficiencies). The complete documentation was sent to Poznan University of Medical Science experts in October 2019.

Based on the comprehensive analysis some conclusions were drawn which in the form of a report were formulated with a recommendation to forward it to the Kazakh party during individual talks and visits. In the period between November and December 2019, Professor Michal Nowicki also prepared the lectures which were conducted for the Kazakh visitors in January 2020.

In January and February 2020 Professor Maciej Krawczyński continued the comparison of the methods used at the WKMOMU and at PUMS in terms of the student clinical training at clinical facilities at the WKMOMU, as well as the methods of the teaching quality evaluation. His task was the analysis and comparison of the curricula of basic sciences during medical studies in WKMOMU and PUMS from the point of view of clinical training needs with suggestions of some changes. The analysis was performed on the basis of syllabi sent from the WKMOMU, although it was significantly hindered, since some syllabi (e.g. “Principles of anatomy” and “Anatomy – course 2”) were sent in Russian, instead of English, and the syllabus for “Chemistry” was sent twice with a different content.

The experts suggestions emphasize that one basic science should be taught as one course during one academic year with a single final exam. For instance, “Anatomy” should be taught as one course with one final exam instead of three: “Principles of anatomy”, “Anatomy I” and “Anatomy II” taught in the course of two academic years with separate exams.

Some courses should change their names – e.g. “Basics of biomedicine” should be referred to as “Biophysics”, “Chemistry” should be called “Biochemistry”.

It was not clear for experts what the role of the course "Morphology and physiology" is – it seems to be the summary of anatomy, histology and physiology.

The proportion of hours and credit points assigned to the medical sciences and the humanities sciences is disproportionate. We suggest that number of hours (and credit points) assigned for "Modern history of Kazakhstan", "Social with political sciences" and "Philosophy" should be decreased and transferred to the medical sciences.

Another suggestion is that basic medical sciences ("Anatomy", "Histology", "Chemistry", "Biochemistry", "Physiology" and "Biophysics", should be covered during the first year of the studies, whereas the preclinical medical sciences (such as "Microbiology with immunology", "Laboratory diagnostics", "Pathophysiology" and "Pathomorphology") during the second year of the studies.

Generally, the number of hours assigned for the practical classes conducted by the teacher is too small in all the basic sciences. The process of teaching must be more direct (face to face with a teacher) with a smaller amount of self-study (with or without the teacher's supervision).

2.THE DEVELOPMENT OF IMPROVEMENT PLAN FOR THE CLINICAL TRAINING AT THE SELECTED CLINICAL FACILITIES OF THE WKMOMU

In Phase 2 the main planned objective was the development of the methods for the student survey-based teaching quality evaluation for the WKMOMU by the PUMS specialist. Such tool has been prepared at PUMS; however, it needs to be discussed with the WKMOMU teachers and staff members. In fact, there were many details which should be clarified. The first is the type of the survey – either electronic or paper. This may influence the percent of the completed and collected questionnaires. It also enables the electronic data analysis. The tools prepared by PUMS experts were to be discussed with the WKMOMU staff members during a visit of the Polish experts to the WKMOMU in May 2020. Unfortunately, due to the pandemic of COVID-19, this meeting was cancelled.

In the next period of Phase 2 of the project, survey-based methods for assessing student teaching quality suggested by PUMS specialists were analyzed and compared with some former methods used at PUMS. The main goal was to obtain a relatively short and simple questionnaire which should ensure a high return rate with student feedback. The crucial point was to choose the electronic method of collecting the questionnaires, which may be further analyzed by means of computer tools.

Due to the inability to meet with WKMOMU authorities in person, the teaching specialists from PUMS prepared materials necessary for an online meeting with the colleagues from Aktobe in September 2020. The first part of the presentation addressed basic principles of a good survey, such as motivation, feedback, incentives, reminders, confidentiality, and opportunity to evaluate

student learning. The specialists from PUMS emphasized that the student's evaluation proved to directly impact the teaching quality by directing the changes in the teaching process.

In the second part of the presentation, PUMS experts explained how student evaluation of teaching is performed at PUMS. Additionally, the types of reports used in our University were presented.

The prepared presentation served as a basis for the PUMS/WKMOMU meeting, held on October 1st, 2020 via Skype. During this meeting, key-expert Ewelina Gowin presented information about teaching quality assessment and the role of student surveys. The discussed and analyzed issues included basic rules of a good survey, such as motivation, feedback, incentives, reminders, confidentiality, opportunity to evaluate the impact on student learning. A questionnaire, an instruction, and a course evaluation template were sent to the WKMOMU on October 4th, 2020. In the following weeks, the paper versions were introduced (translated into Russian and Kazakh by the WKMOMU staff). The goal was described as collecting the filled-in questionnaires from 30% of the residents from eight chosen specialties, and from 30% of the students from one third of the courses from one level of education. The survey was prepared to be covered on the platform used in PUMS. In December 2020, technical preparation for the online survey for the Kazakh students were completed. The WKMOMU prepared a list of emails (840 from the 6th and 7th year students) and a translation of the questionnaire into Russian and Kazakh. After collecting the completed questionnaires, only these data should be sent back to the WKMOMU for further analysis. On December 22nd, 2020, a next on-line meeting using Skype was organized with the participation of Roza Nurgaliyeva responsible for Task 1A3 at the WKMOMU and key-experts Marzena Dworacka and Ewelina Gowin. During this meeting, all aspects and details of the survey for the WKMOMU students were discussed and arranged.

Finally, at the beginning of January 2021, as part of the education quality assessment, an online survey among students was performed. It continued from January 15th until February 5th. Students were asked to fill questionnaires with opinions about the course. Links (https://olat.ump.edu.pl) were sent to 806 students – 407 from the 6th year and 398 from the 7th year. Each student received an individual account with a login and a password.

There were nine closed questions – statements about the course. Students were asked to rate the statement according to the scale: from strongly disagree to agree strongly.

In the last question, students were asked to rate the course on a scale from 1 to 5.

The overall response rate was 81.24% - 85.74% (349/407 students from 6th year) and 76.63% (305/398 students from the 7th year). The results of this survey were analyzed in detail by PUMS experts before preparing the final report.

Unfortunately, due to the COVID-19 pandemic, PUMS experts could not participate in the educational activities at the WKMOMU. Since it was crucial to meet the project's goals, it was decided to choose an alternative way of action. In the group of PUMS experts, the four most basic

courses which play a crucial role in educating future doctors were pinpointed. These include: Internal medicine, Pediatrics, Surgery, and General medicine/Family medicine.

The analysis of the current clinical training at clinical facilities at the WKMOMU was performed by three methods which comprised: a review of the syllabi of the four courses mentioned above, a survey among the academic teachers who responded to detailed questions regarding the way they organize the clinical training, and by a student satisfaction survey concerning clinical teaching on General Practice course.

The syllabi for the four main courses: Internal medicine, Pediatrics, Surgery, and General Medicine/Family Medicine were analyzed in detail by PUMS experts – specialists in the relevant fields of medicine. The main goal of this analysis was to identify directions for improving the quality of the clinical training. The investigation into the syllabi was supplemented with a description of the methods used in the clinical training obtained from questionnaires for academic teachers.

The results of the review of the selected syllabi supplemented by the results of an online survey for the WKMOMU students constituted a basis to outline the improvement plan of the clinical training at selected clinical facilities of the WKMOMU.

3. <u>ATTACHED DOCUMENTS</u>

Attachment 1A.3 – I – The Improvement Plan for the clinical training at selected clinical facilities of the WKMOMU.

Attachment 1A.3 – II Principles of internal diseases – syllabus report

Attachment 1A.3 – III The Analysis of Pediatrics. Propedeutics of children's diseases

Attachment 1A.3 – IV The Analysis of Pediatrics. Principles of children's diseases

Attachment 1A.3 - V The Improvement Plan for the surgery course at the West Kazakhstan Marat Ospanov Medical University (WKMOMU) in Aktobe

Attachment 1A.3 – VI The Principles of a General Practice – the analysis of the syllabus and clinical training

SUBTASK 1A4
"Development of an Action Plan for improvement of medical education at the PhD level"

Task Leader:	Prof. Jacek Wysocki
Subtask Leader:	Prof. Jarosław Walkowiak
Key-experts:	Prof. Maciej Krawczyński
	Prof. Michał Nowicki
	Prof. Jarosław Walkowiak
	Prof. Jacek Wysocki
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	Report containing:
	(1) Analysis of scientific achievements of PhD students at WKMOMU.
	(2) Comparison of PhD studies at WKMOMU and at PUMS.
	(3) The action plan for improvement of medical education at the PhD level.

1. ANALYSIS OF SCIENTIFIC ACHIEVEMENTS OF PHD STUDENTS AT WKMOMU.

a/ scientific achievements of PhD Students (courses: 2016-2019, 2017-2020 & 2018-2021; n=21) – as for March 2021

According to the information delivered by the proper department of WKMOMU, PhD students should publish in respective journals: *„Articles in international peer-reviewed scientific journals are counted for the group of specialties Medicine in publications with a non-zero impact factor in the database of the information company Clarivate Analytics (Clarivate Analytics) (Web of Science Core Collection, Clarivate Analytics (Web of Science Core Collection, Clarivate Analytics)) or included in the Scopus database (Scopus), Pubmed (Pabmed), Footnote. Clause 6 as amended by order of the Minister of Education and Science of the Republic of Kazakhstan dated 04.12.2017 No. 606"*. And as declared by the chair of this department, PhD students fulfilled respective criteria.

However, a significant proportion of PhD Students have no publication in Scopus, no citation / Hirsch Index (HI)=0 (71.4%), and no IF publication (85.7%). Publications of four students have been cited (Scopus) once, and papers of two students have been cited twice and three times, respectively. There are three (14.7%) students who co-authored one IF publication. The summary of WKMOMU PhD student achievements has been presented in Table 1 and Figures 1-5.

Table 1. Research achievements of WKMOMU PhD students.

	Median (IQR)			
	Total (n=21)	**2016-2019 (n=6)**	**2017-2020 (n=7)**	**2018-2021 (n=8)**
HI	0 (0 – 1)	0 (0 – 1)	0 (0 – 0)	0 (0 – 1)
Citations	0 (0 – 1)	0 (0 – 1)	0 (0 – 0)	0 (0 – 1)
Publications	1 (0 – 2)	2 (1 – 2)	1 (0 – 2)	1 (0 – 1)
IF publications	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)	0 (0 – 0)
Total IF	0.000 (0.00 – 0.000)	0.000 (0.000 – 0.000)	0.000 (0.000 – 0.000)	0.000 (0.000 – 0.000)

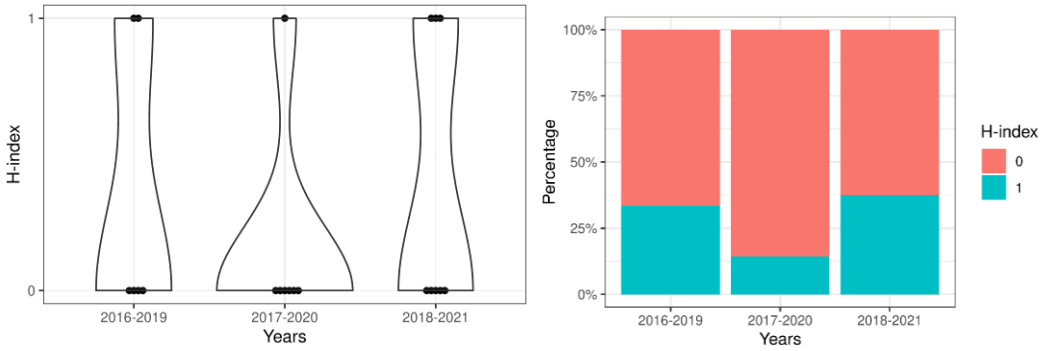


Figure 1. Hirsch index of WKMOMU PhD students.

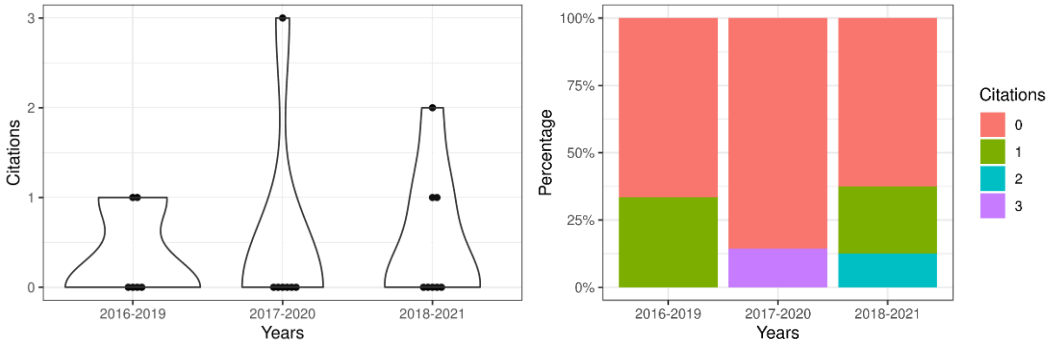


Figure 2. Number of citations of WKMOMU PhD students.

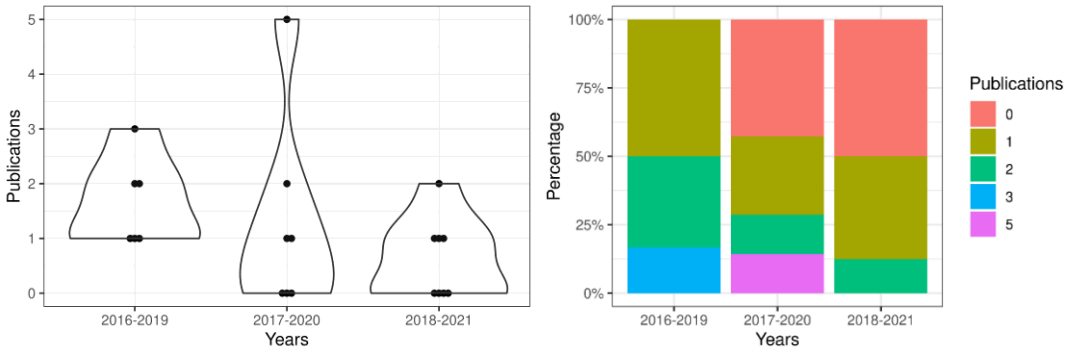


Figure 3. Number of publications of WKMOMU PhD students.

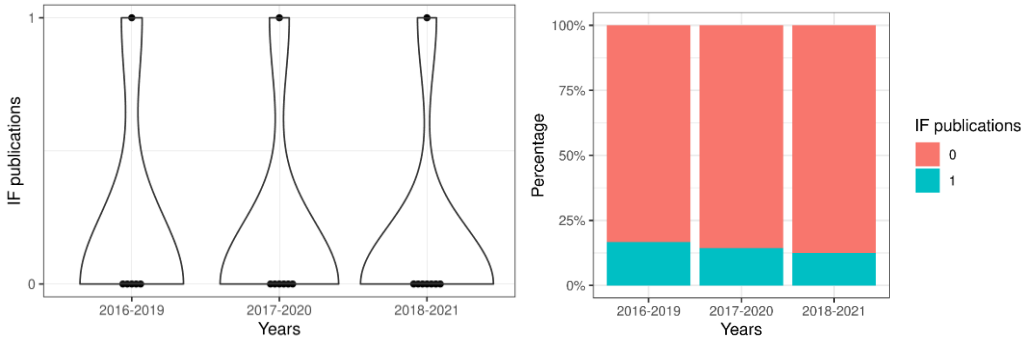


Figure 4. Number of IF publications of WKMOMU PhD students.

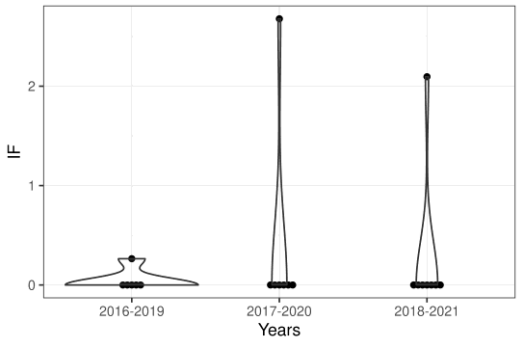


Figure 5. Total IF of WKMOMU PhD students.

b/ scientific achievements of supervisors (courses: 2016-2019, 2017-2020 & 2018-2021; n=21) – as for March 2021

According to information delivered by the respective department of WKMOMU, the main requirement for scientific consultant until 2020 was the academic degree: *"Scientific guidance of doctoral students for the degree of doctor in the profile is carried out by consultants in the number of at least 2 people appointed from among doctors or candidates of science, or doctors of philosophy (PhD), one of whom is a highly qualified specialist in the healthcare industry"*.

Since 2020 the rules have been upgraded: *"Academic supervision is carried out by a teacher who has the academic degree "Candidate of Science", or "Doctor of Science", or "Doctor of Philosophy (PhD)", or "Doctor of Profile", or the academic degree "Doctor of Philosophy (PhD)", or "doctor in the profile", or the degree "doctor of philosophy (PhD)", or "doctor in the profile", experience of scientific and pedagogical work at least three years, who is the author: in the areas of training 8D10 "Health and social security (medicine) "2 articles in international peer-reviewed scientific journals included in the 1, 2, 3 quartile according to the JCR (WSR) data in the Web of*

*Science Core Collection (Web of Science Core Collection) or having a CiteScore (SiteScor) percentile of at least 35, or Hirsch index 2 or m*ore http://adilet.zan.kz/rus/docs/V1800017669/historyore;"

And as declared by the chair of the respective department, PhD students fulfilled adequate criteria.

However, there is a considerable percentage of supervisors with no publication in Scopus, no citation, and no IF publication (33.3%). Additional seven (33.3%) supervisors published only one IF publication. The summary of WKMOMU supervisor achievements has been presented in Table 2 and Figures 6-10. Interestingly, even with so many "null values", there is a significant correlation between PhD students' and supervisors' Hirsch index (rho=0.5367; p=0.0121) and the number of Scopus citations (rho=0.5148; p=0.0169) (Table 3).

Table 2. Research achievements of supervisors.

	Median (IQR)			
	Total (n=21)	**2016-2019 (n=6)**	**2017-2020 (n=7)**	**2018-2021 (n=8)**
HI	2 (0 – 3)	2 (1 – 2)	2 (0 – 6)	2 (0 – 4)
Citations	7 (0 – 37)	10 (2 – 19)	7 (0 – 89)	9 (0 – 46)
Publications	6 (4 – 13)	6 (5 – 12)	6 (2 – 24)	8 (3 – 14)
IF publications	1 (0 – 3)	1 (1 – 3)	1 (0 – 7)	1 (0 – 3)
Total IF	2.678 (0.000 – 4.186)	2.052 (1.214 – 4.816)	0.712 (0.000 – 14.891)	2.778 (0.000 – 4.517)

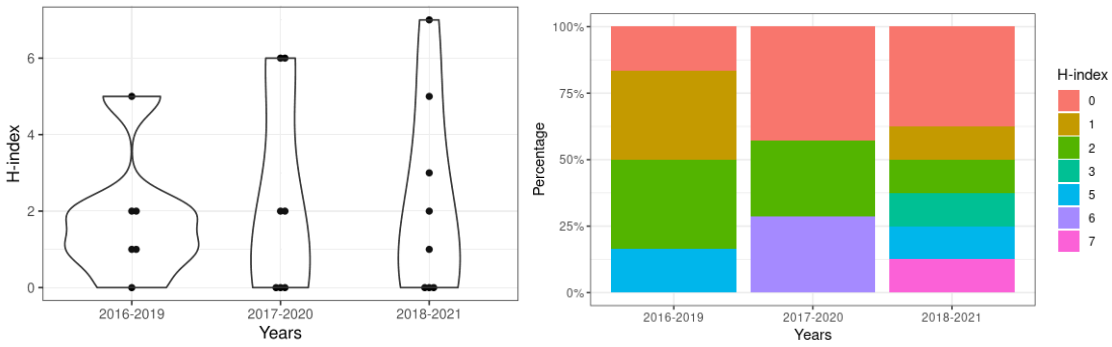


Figure 6. Hirsch index of WKMOMU supervisors.

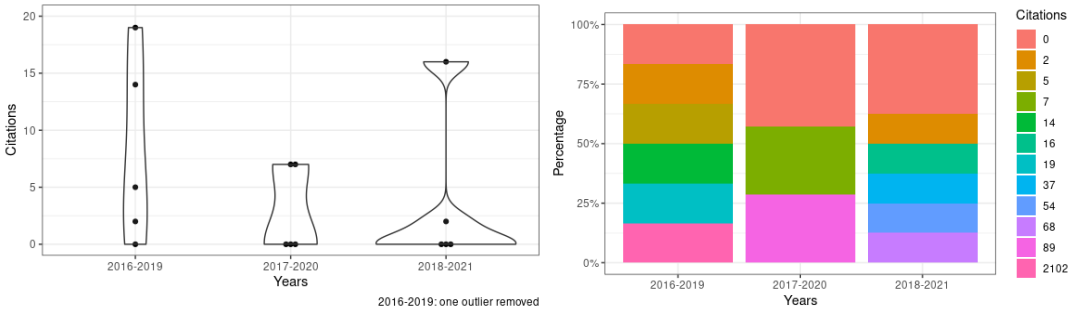


Figure 7. Number of citations of WKMOMU supervisors.

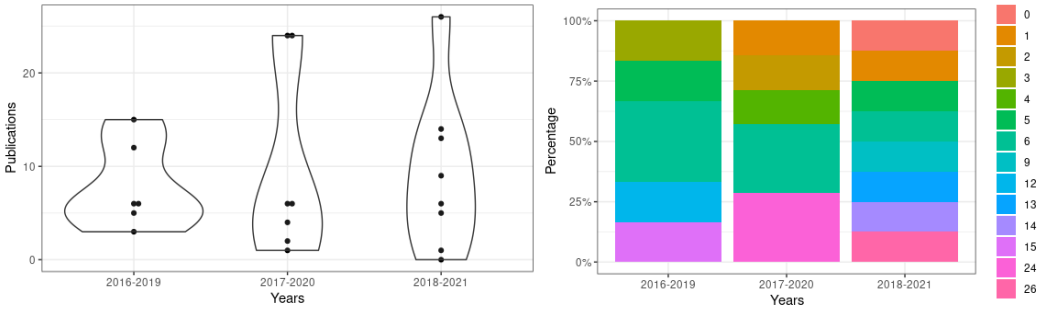


Figure 8. Number of publications of WKMOMU supervisors.

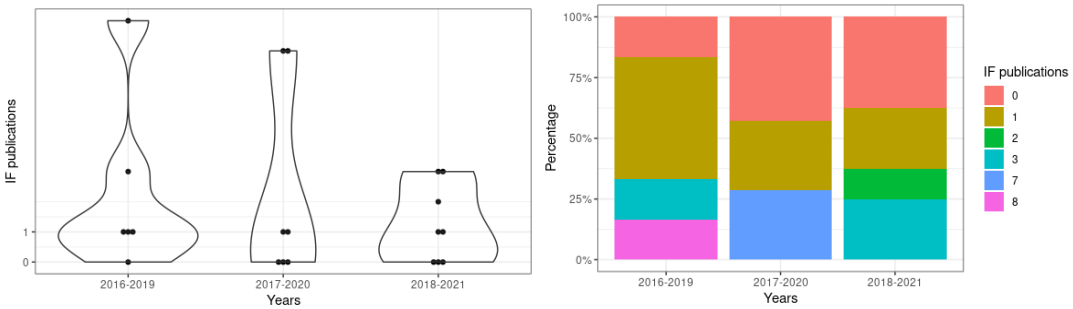


Figure 9. Number of IF publications of WKMOMU supervisors.

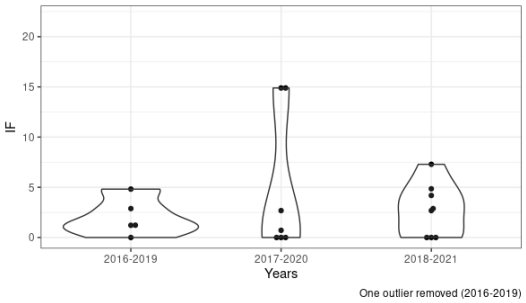


Figure 10. Total IF of WKMOMU supervisors.

Table 3. Spearman correlation between research achievements of WKMOMU PhD students and supervisors.

	Total		2016-2019		2017-2020		2018-2021	
	rho	p	Rho	p	Rho	p	rho	p
HI	0.5367	0.0121	0.0000	1.0000	0.5401	0.2108	0.8660	0.0054
Citations	0.5148	0.0169	0.0000	1.0000	0.5401	0.2108	0.8874	0.0033
Publications	0.3257	0.1496	0.3914	0.4429	0.3144	0.4922	0.5738	0.1369
IF publications	0.3741	0.0948	0.6956	0.1249	0.1080	0.8177	0.5135	0.1930
Total IF	0.3790	0.0902	0.6547	0.1583	0.2139	0.6451	0.5916	0.1224

c/ scientific achievements of foreign supervisors (courses: 2016-2019, 2017-2020 & 2018-2021; n=22) – as for March 2021

In terms of foreign supervisors (n=22), the situation looks better. Each supervisor has at least one publication indexed in Scopus. However, having in mind their expected function (facilitating IF publications), their academic achievements do not look convincing. Two supervisors have no citation and their HI=0 (Scopus), and four subsequent have no IF publication. Seven foreign supervisors are characterized by low HI values: 1 (two supervisors), 2 (one supervisor) and 3 (four supervisors). Three supervisors were cited very rarely (from 1 to 11 times). Five supervisors published very few IF papers (from 2 to 4). However, there is a subset of recognized researchers. Nine supervisors' HI is higher than 10, and eleven supervisors were cited more than 100 times (the best-cited supervisor is involved in three PhD theses – and was included three times in the analysis). The summary of their achievements has been presented in Table 4 and Figures 11-13.

Table 4. Research achievements of foreign supervisors.

	Median (IQR)			
	Total (n=22)	2016-2019 (n=7)	2017-2020 (n=7)	2018-2021 (n=8)
HI	6 (3 – 143)	5 (1 – 15)	3 (0 – 6)	11 (6 – 18)
Citations	99 (23 – 636)	61 (4 – 1005)	23 (0 – 136)	425 (184 – 1202)
Publications	21 (9 – 87)	33 (5 – 87)	13 (1 – 24)	66 (16 – 143)

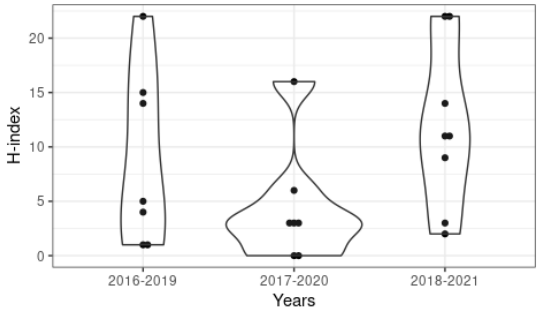


Figure 11. Hirsch index of foreign supervisors.

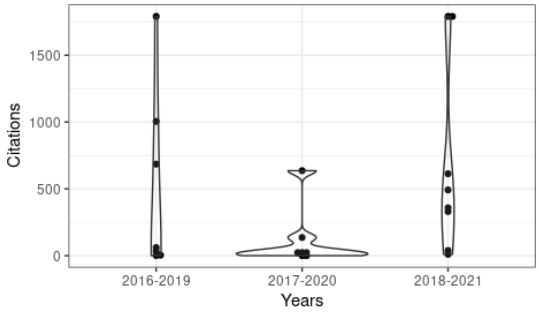


Figure 12. Number of citations of foreign supervisors.

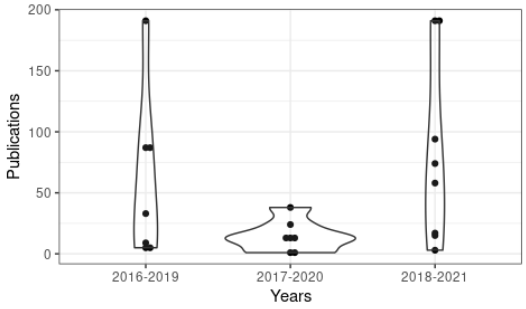


Figure 13. Number of publications of foreign supervisors.

Few general remarks related to the assessment of research activity in Kazakhstan could be given. The analysis is based upon Scopus, not Web of Science. Therefore, it comprises a lot of non-IF publications. Besides, even for IF items, there is no differentiation between original/review papers and published abstracts, letters to editors, collaboration in/ contribution to multiple-author publications (e.g., hundreds or a thousand of collaborators/contributors not listed in

author box). The latter category, in fact, should not be treated as regular publication achievements (although they are counted for citation number and HI). Moreover, nobody looks into the author's position, especially in terms of first or senior authorship (last position among authors), which points to the leading/meaningful contribution to the publication.

2. COMPARISON OF PHD STUDIES AT WKMOMU AND AT PUMS.

A/ recruitment process to PhD program

According to the present and future requirements, *"…persons with a master's degree and at least one year of work experience or who have completed residency training in medical specialties are accepted for doctoral studies"*. The assumption that clinical residency training equals obtaining master's degree with at least one year of work experience raises serious concerns. Doctoral studies should be dedicated to research activity and based on it (residency is a practical medical training and has nothing to do with research activity). This assumption should be considered in future modifications of any regulations for entry demands for PhD candidates. However, temporarily (transition from old to new MD studies program) it could remain in effect.

&5.1 of the internal WKMOMU regulation states: *"Persons entering PhD program, when applying to the University, submit…" "…4) electronic international certificate confirming foreign language proficiency in accordance with the common European competencies (standards) of foreign language proficiency (English, German, French) for the programs International English Language Tests system (IELTS, passing score – at least 5.5), IELTS INDICATOR (IELTS indicator) passing score – at least 5.5, Test of English as a Foreign language institutional testing program (TOEFL ITP (toyfl itypi) passing score – not less than 460 points, Test of English as a foreign language institutional testing program Internet-based Test (TOEFL IBT) passing score – not less than 46, Test of English as a Foreign Language Paper-based testing (TOEFL PBT) passing score – not less than 453, Duolingo English Test (Duolingo English test), passing score – not less than less than 85, common European framework of reference (CEFR, passing score – B2), deutsche sprachpruefungfuerden hochschulzugang (DSH, Niveau B2/level B2), TestDaF-prufung (niveau B2/level B2), test de franchais international™ (TFI– not lower than level B2 in reading and listening sections), Diplomed'etudesen languefranzaise (DELF, level B2), Diplome Approfondide Langue française (DALF, level B2), Test de connaissancedufranzais (TCF – at least 50 points);"* The same rules are in effect when applying via portal (&5.5). However, considering the research effects of Doctoral Studies, it seems justified to consider the English language only. The key-expert had the chance to meet four grades of PhD students (from those who started doctoral education in 2016

to these who entered the course in 2019, as well as several candidates for the recent 2020 call). A significant problem identified in many students was the lack of basic English skills.

According to &2.18, &2.20, &4.4, &4.3, preselection based upon the planned dissertation results in admission or non-admission to doctoral studies. The research plan does not play any role in the further selection, even for the doctoral program under the state education al order. The research plan seems to be a critical point for the potential success of future PhD student work (e.g., for IF publications).

According to &4.4 and &7.4, the candidate's research achievements are taken into consideration as a minor, practically non-significant criterion of the assessment (in case of an equal score obtained during entry exam). Moreover, the emphasis is put on several less meaningful points (see Appendix 2 below). There are several issues that should be thoroughly considered. The continuation of research direction started during the master's degree program could be a disadvantage, assuming its quality was not good. The scoring system is not balanced. The equal weight put on IF publication (rare achievement) with no regard to auth orship position, international (in fact regional) congress presentation, patent (very frequently documented) and just simply participation in a research project (what should, in fact, result in good publications) does not seem to be justified.

The planned dissertation's evaluation system presented in Appendix 1 should be revised to omit the repetitiveness of criteria and clearly refer to the particular project, not to the field of research.

In the plans for the nearest future (as delivered by WKMOMU), a scale of the 100-point grading system for admission to doctoral studies was proposed (Table 1). With hopefully an increasing number of applicants, both the research plan and publication list should receive more significant attention for the final decision.

Appendix 2 (as supplied by WKMOMU)

to the Rules for admission to the PhD program
NJSC «Marat Ospanov WKMU»

Criteria for evaluating a candidate's portfolio for doctoral studies
(for three years)

No.	Indicators	Score for 1 unit	Total units	Amount
1	the scientific work is a continuation of the scientific direction started during the master's degree program	100	Extract from the minutes of the meeting of the State attestation Commission on the defense of master's theses	

2	Participation in: - scientific programs and projects implemented within the framework of grant funding of the Ministry of health or the Ministry of education and science of the Republic of Kazakhstan; - research programmes and projects carried out within the framework of other forms of financing	100 80	certificate from the Vice-rector for clinical and scientific work	
3	Co-authored published articles: - in international peer-reviewed scientific publications indexed in authoritative databases of scientific information (Web of Knowledge, Scopus, Springer); - in scientific journals of the CIS; - in journals recommended by the Committee for control in the field of education and science of the Republic of Kazakhstan; - the magazine of the University; - in scientific journals of Kazakhstan	100 80 50 50 30	reprints of publications	
4	Availability: - patents for inventions - copyright certificate	 100 50	copies	
5	Participation in international conferences and forums: - an oral report (with travel abroad); - an oral report (in the territory of the Republic of Kazakhstan); - oral report (University); - with the publication of the thesis (articles) in the conference proceedings indexed in authoritative databases of scientific information (Web of Knowledge, Scopus); - with the publication of the thesis (articles) in the conference proceedings, indexed databases of scientific information of the Republic of Kazakhstan and CIS countries	 100 80 30 100 50	copies of the conference program, copies of publications	
6	Availability of certificates, diplomas, certificates: - international; - republican	 100 50		
	Total			

Note: if there are no supporting documents, no points are awarded.

Signature of the applicant for training _____

Signature of the person responsible for receiving documents _____

Appendix 1 (*as supplied by WKMOMU*)

to the Rules for admission to the PhD program
NJSC «Marat Ospanov WKMU»

Evaluation sheet for the presentation of the planned dissertation work

No.	Criteria for the planned topic of the dissertation work	Points (0-4)
1	Relevance (degree of relevance of the dissertation work)	
2	Purpose and objectives (correspondence of the goal and objectives to the topic of the dissertation)	
3	Scientific novelty (to what extent the expected scientific results will be new in the relevant field of medicine)	
4	Research object and methodology (substantiation of the research object, sample and research design)	
5	Expected results (practical significance)	

Table 1 100-point grading system for admission to doctoral studies

Types of test	Points
Essay	20
Test for readiness to study in the doctoral program	30
Exam on the profile of the group of the educational program	50
Total	100

According to the plans for the nearest future (as delivered by WKMOMU), the scientific guidance will be provided by *"a lecturer having a scientific degree «PhD» or «PhD» or «doctor of philosophy (PhD)», or doctor on the profile, or academic degree «doctor of philosophy (PhD)» or doctor on the profile, the experience of scientific and pedagogical work at least three years, who is the author: - in the areas of training 8D10 «Health and social security (medicine)» 2 articles in international peer-reviewed scientific journals that are included in the 1,2,3 quartile according to JCR data in the Web of Science Core Collection (Web of Science Core Collection) or have a CiteScore percentile of at least 35, or an the Hirsch index of 2 or more."* The direction of changes is justified. The analysis of the research achievements of WKMOMU supervisors was performed (see 1b). It points to the need for extensive changes in the perception of their possible roles.

b/ PhD thesis pre-defense and defense procedures and responsibilities of "Problem commission" and "Dissertation Council"

1/ Sources of information

The analysis of the current status of the PhD thesis procedures at WKMOMU was based on the data included in two documents sent by e-mail from Aktobe, entitled "About the pre-defense of dissertations for PhD degree at the problem commission" and "About the dissertation council at West Kazakhstan Marat Ospanov Medical University". The documents are dated on 2020 and are said to present the regulations adopted on October 10th, 2019.

Similar data regarding the corresponding procedures at PUMS and at some chosen European universities were collected by the key-experts and compared to the data sent from Aktobe.

2/ European assumptions and standards regarding the PhD procedures

In the European countries there are two basic models of the PhD procedures. The first is based on the full-time research job in the university department under the guidance of a supervisor. The second is based on PhD studies. The PhD studies become a more and more popular way of scientific career and they are based on the following assumptions:

- PhD studies should be conducted directly (or shortly) after the university studies ending with Master of Sciences degree (or equivalent);
- Duration of PhD studies should be 4 years and they should allow to educate an independent scientist;
- They should allow to obtain the PhD degree before 30. year of life (maximum 35);
- The candidate must be fluent in English and present the Cambridge Certificate in Advanced English or equivalent;
- The research work and preparation of the manuscript must be done under close supervision of a doctoral advisor;
- The Dissertation Council is chosen at the University for each candidate and each PhD thesis separately and consists of experienced scientists in the given field of medicine;
- The PhD thesis is and object of expert assessment (done by external reviewers) and open, public, adversarial (contradictorial) defense. The defense is based on the lecture given by the candidate, remarks of the reviewers and open discussion with audience participation.

The following standards of PhD studies regarding freedom of science and autonomy of the scientific life should be fulfilled:

- free choice of topics and methods of research,

- open access to scientific literature,
- open, transparent competition for financing research grants,
- free scientific information flow and free contacts (also international) between researchers.

3/ Analysis of the current status of the PhD procedures at WKMOMU

The analysis of the documents indicates that the course of PhD procedure comprises a multi-stage and complicated activity of the candidate (who is superintended by two supervisors – one local and one foreign) and many different collegial bodies (commissions, councils and committees).

It is possible to identify four stages of the procedure:

1. The first stage of pre-defense is carried out at an open meeting of the Department that was the place of scientific activity and preparation of the dissertation, with participation of some invited guests and specialists. The decision regarding the dissertation is done by open voting and is expressed in a written protocol.
2. The second stage of pre-defense is carried out at a closed meeting of so-called "Problem Commission" that is appointed by the Vice-Rector for Clinical and Scientific Work of WKMOMU. This commission consists of at least 3 specialists with academic degree. It is not specified if they are specialists in field of dissertation topic. The "Problem Commission" makes a formal assessment of the documents (bioethical committee opinion, anti-plagiarism testing results, conflict of interests declaration, list of publications, manuscript of the dissertation, protocol from the Department Meeting), chooses two internal reviewers from WKMOMU, prepares the pre-defense meeting with presentation of the dissertation and reviews, open discussion, and after an open voting prepares the final report for the "Dissertation Council".
3. PhD thesis defense that is carried out at the meeting at so-called "Dissertation Council". This council is appointed by the Rector of WKMOMU upon proposal of the Academic Council of the University for a 3-year period. It consists of at least 6 specialists with scientific degree, and at least half of them must come from outside the University. It means that the Council is chosen for all PhD defenses that will take place at WKMOMU during a 3-year period. The "Dissertation Council" accepts the documentation, chooses two external reviewers, chooses the date and conducts the public defense, and prepares a report regarding its activity and conclusions.
4. The Committee for Control in Education and Science of the Ministry of Education and Science controls the activity of "Dissertation Council", collects the final reports and eventual appeals of the candidates and makes a decision regarding the PhD degree.

To summarize the analysis of the PhD thesis procedure it is necessary to state that the following problems were identified:

- It seems that the PhD pre-defense and defense procedures currently practiced at WKMOMU are very complicated and in all stages of action they partially overlap.
- The candidate must present the dissertation three times on the forum of three different collegial bodies.
- The dissertation is reviewed two times by four reviewers, and two of them are workers of WKMOMU.
- It also seems that the members of the "Problem Commission" and especially the members of the "Dissertation Council" usually do not represent the field of medicine that is the topic of the dissertation, what makes the reliable assessment of the dissertation very difficult or even impossible.
- It is also clearly depicted that after all the stages of defense procedure, the decisions are made on the basis of open voting.

C/ PhD study program and organizational issues

Generally, completing PhD degree (both in medicine and public health) should enable candidates to provide leadership in the profession through their advancement and dissemination of knowledge. Graduating students should demonstrate a broad base of established and evolving knowledge within a chosen discipline and detailed knowledge of a specific research area. Students should understand the gaps, conflicts, limits, and challenges within their research area so that they can develop testable hypotheses.

1/ Organization of PhD studies at WKMOMU

The modular educational program for doctoral students in medicine and public health (involving both scientific and pedagogical directions) is well prepared, comprehensive document. In its assumptions, it refers to the European frame of qualifications, which, in our opinion, is extremely accurate. Basically, the implementation of the program may translate into the formation of a new elite of scientists prepared to conduct advanced scientific research in international cooperation. It should be mentioned that key-experts did not receive National Framework Documents.

There are, however, a few uncertainties in the regulations mentioned above that should be clarified.

1. First of all, the document should contain clear information that "foreign cooperation" or "foreign language" refers to the scientific (educational) cooperation with research centers situated abroad which use English in their common research communication. In other words, the program should prepare graduates to undertake research work in centers abroad where the language of scientific communication is English.
2. In line with the standards of the Organization for PhD Education in Biomedicine and Health Sciences in the European System (ORPHEUS) and the Association of Medical Schools in Europe (AMSE):
    a. all the PhD programs must be performed in a strong research environment. It means that the Institutions lacking facilities or expertise in particular fields should collaborate with stronger institutions to ensure that the graduate school can offer PhD programs of the required standard,
    b. PhD programs should include time in another laboratory, preferably in another country, to promote internationalization,
    c. PhD program leading to obtaining PhD degree must provide students with competencies that enable them to become qualified researcherers; that is scientists able to conduct responsible, independent research, according to principles of good research practice,
    d. completion of a PhD program must also be of potential benefit for those who chose to have a career outside of academic or clinical research, by use of competencies achieved during the PhD program, including the ability to solve complex problems by critical analysis and evaluation, and appropriate transfer of new technology and synthesis of new ideas.
3. Accordingly to World Federation for Medical Education (WFME) recommendations:
    a. PhD programs must ensure that students have substantial training in the rules concerning ethics and responsible conduct in research,
    b. there must be arrangements to allow PhD students, if relevant, to perform part of their PhD program at another institution, including those in other countries,
    c. the number of PhD students per supervisor must be compatible with the supervisor's workload,
    d. supervisors must be scientifically qualified and active scholars in the field concerned; they must have regular consultations with their students.
4. The list of competencies is well described, it should be, however, considered thoroughly in terms of subsequent competencies (as listed below)
    a. improving confidence and identity, strengthening personal resources, enhancing the quality of life, and contribution to the realization of aspirations,

b. practicing rigor, honesty, and integrity in experimental design, performance, and data analysis as well as the ability to report data with acceptable standards of reproducibility,
c. understanding personal, intellectual, and financial conflicts of interest,
d. understanding confidentiality and bias in peer review,
e. graduating students should fully understand the importance of adhering to accepted professional standards and practices within the workplace, institution, and discipline. It means, they should:
    i. be able to assess and uphold workplace etiquette,
    ii. understand and comply with rules, regulations, and institutional norms,
    iii. respect, evaluate, and enhance the intellectual contributions of others,
    iv. identify and manage apparent and actual conflicts of interest, ethical violations, and violations of expected professional behavior.

B/ Comparison of PhD studies at WKMOMU and at PUMS.

The list of potential competencies, the achievement of which should be expressed in PhD study program, was presented above.

Below, we present skills, knowledge and work styles to which special attention should be paid at every University and which should be emphasized:

1. Skills:
    a. using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems,
    b. understanding the implications of new information for both current and future problem-solving and decision-making,
    c. giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times,
    d. considering the relative costs and benefits of potential actions to choose the most appropriate one,
    e. Complex Problem Solving - Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions,
    f. Systems Analysis - Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes,
    g. Systems Evaluation - Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system,
    h. Social Perceptiveness - Being aware of others' reactions and understanding why they react as they do,

i. using mathematics to solve problems (not only statistics),
j. Learning Strategies - Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things,
k. Time Management - Managing one's own time and the time of others,
l. Persuasion - Persuading others to change their minds or behavior,
m. Management of Personnel Resources - Motivating, developing, and directing people as they work, identifying the best people for the job,
n. Negotiation - Bringing others together and trying to reconcile differences.

2. Knowledge:
    a. English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar,
    b. Medicine and Dentistry - Knowledge of the information and techniques needed to diagnose and treat human injuries, diseases, and deformities. This includes symptoms, treatment alternatives, drug properties and interactions, and preventive health-care measures,
3. Work styles:
    a. Analytical Thinking - analyzing information and using logic to address work-related issues and problems,
    b. Integrity - being honest and ethical,
    c. Attention to Detail - being careful about detail and thorough in completing work tasks,
    d. Dependability - being reliable, responsible, and dependable, and fulfilling obligations
    e. Initiative - a willingness to take on responsibilities and challenges,
    f. Persistence - persistence in the face of obstacles,
    g. Achievement/Effort - establishing and maintaining personally challenging achievement goals and exerting effort toward mastering tasks,
    h. Leadership - a willingness to lead, take charge, and offer opinions and direction,
    i. Cooperation - being pleasant with others and displaying a good-natured, cooperative attitude,
    j. Independence - developing one's own ways of doing things, guiding oneself with little or no supervision, and depending on oneself to get things done,
    k. Innovation - creativity and alternative thinking to develop new ideas for and answers to work-related problems,
    l. Adaptability/Flexibility - being open to change (positive or negative) and to considerable variety in the workplace,
    m. Stress Tolerance - accepting criticism and dealing calmly and effectively with high-pressure situations,

n. Self Control - maintaining composure, keeping emotions in check, controlling anger, and avoiding aggressive behavior, even in very difficult situations,
o. Concern for Others - being sensitive to others' needs and feelings ,
p. Social Orientation - preferring to work with others rather than alone.

WKMOMU program and course of PhD studies contains a catalog of module descriptions, including:

1. good practice in conducting scientific research,
2. statistical analysis and presentation of data in scientific research,
3. typical forms of research design,
4. structure of modern scientific article,
5. pedagogical practice,
6. research practice.

Every module mentioned above is described accordingly to the number of contact hours as well as detailed scope of knowledge. In the catalog of modules, one cannot find any information about "philosophy" or "history of medicine," which should be present in PhD program. Moreover, there are no labs concerning the improvement of academic English knowledge, which, in our opinion (having in mind what we experienced), is vital in conducting international research.

The direct program comparison of PhD studies at WKMOMU and PUMS has been presented in Table 2.

Table 2 Complex comparison of PhD studies at WKMOMU and at PUMS (the number of hours expressed for whole studies if not indicated otherwise)

Feature	PUMS	WKMOMU
Duration of PhD studies	4 years (8 semesters)*	3 years (6 semesters)
Program character	Effect-based	Modular-based
Total number of hours that PhD a student spends on research, education and pedagogical activity	Not specified (the general assumption – the equivalent of full-time employment)	5400
Number of contact hours that a PhD student is expected to work as a teacher (pedagogical practice)	210	120
Number of contact educational teaching hours	$\geq$484 ($\geq$45)	1290 (435)

(including PhD student's choice)		
Obligatory English upgrade courses (Academic English)	45	-
Basic program differences	History of medicine Philosophy	Cycle of profile disciplines by choice
Research practice (external fellowship)	Optional (recommended; exclusively high-quality Universities' departments or research institutions)*	180 - mandatory scientific training in scientific organization and (or) organizations of relevant industries or fields of activity, including abroad.
Grant application	Recommended*	Optional
Participation in University-based or external projects	Recommended*	Not mentioned
Participation in PhD School workshops and summer schools	Recommended*	Not mentioned
Participation in external courses (also online)	Recommended at least once per year*	Not mentioned
PhD student assessment	Effect-based (e.g., publication every year)	Report-based
Final conclusion	Cycle of publication with a summary of achievements (at least three first authorship IF publications expected) At least one additional publication	Monography Two publications with IF (or one IF publication and one indexed in Scopus) – with no regard to the author's position
Acquiring the ability to conduct research in an international environment	Yes	Unclear

* could be shortened in very successful cases (exceptional situation; by no more than 12 months)

** optional as a single choice – at least two to three of them should happen (otherwise, Doctoral School authorities would not accept individual research plan and annual reports).

3. THE ACTION PLAN FOR IMPROVEMENT OF MEDICAL EDUCATION AT THE PHD LEVEL.

a/ research activity of PhD students and basic demands for scientific background of supervisors

The key-experts would recommend subsequent directions for changes and potential goals:

1/ PhD students should be involved in research activities that allow achieving IF publications (e.g., in cooperation with international supervisors). Besides, they should aim to be a first author in one to two IF publications based upon their PhD theses (during PhD studies or within two subsequent years).

2/ WKMOMU supervisor should be an active researcher with at least two to three IF publications with first or last authorship, respectively, pointing to own "reasonable" research activity or leading an active research team.

3/ International supervisor should be a recognized researcher with at least moderate research activity and several IF publications. Kazakh University should aim at involving her/him in internal University research activity. Moreover, PhD students and their national supervisors should try to be involved in the research activity of the supervisor's institution.

4/ for further comments on general research issues – please refer to Task 1C "Development of institutional research capacity of the WKSMU[1]" – subtask 1C2 and 1C3.

B/ recruitment process to a PhD program

The key-experts would recommend subsequent directions for changes and potential goals:

1/ The language exam should be held by an independent external institution guaranteeing reliable language skills assessment. The inability to speak English should be a strict decision-making criterion resulting in non-admission. Another option is an introductory language course for those PhD students who are non-fluent in English (adapted to particular students' level). A proper external language school (located outside of Kazakhstan) or research institution (e.g., strategic partnership University) should provide such a course and constantly monitor the language improvement. Lack of progress (e.g., IELTS 5.5 or 6 within one year) should result in removal from the list of PhD students.

2/ Research plan and research achievements should be included in the grading system for admission to doctoral studies. Besides, the language exam could also be considered for inclusion in the scoring system (see also point 3-4).

3/ Appendix 1 should be revised to cover the expected points of interest adequately. The criteria should not overlap. Please find the potential example below (Appendix 1 revised).

[1] WKSMU - former name of the medical university in Aktobe

Appendix 1 revised

Evaluation sheet for the presentation of the planned dissertation work

No.	Criteria for the planned topic of the dissertation work	Points (0-4)
1	Up-to-dateness and originality of the proposed work*	
2	Material (selection methods, sample size, control group, etc.)	
3	Methodology (actual & proper methods, team experience, etc.)	
4	Research hypotheses (clear and achievable aims, etc.)	
5	Scientific novelty & practical significance (scientific and practical value)	

* not research area

4/ The criteria for a candidate's portfolio should undergo proper revision, emphasizing publications (especially with IF), not conferences or other less relevant activities. Appendix 2 should be revised. The scoring system should refer thoroughly to the significance of the achievement. Please find the potential examples for scoring system for different categories below (Tables 3-5). Four or three highest-scored publications/conferences (in each category) could be subject to evaluation.

Table 3. Proposed scoring system for IF publications

Author	Quartile according to Journal Citation Reports of the Web of Science database for a year of publication (or most recent year)			
	Q4	Q3	Q2	Q1
first	7	10	15	20
second	4	7	10	15
remaining	2	4	7	10

Table 4. Proposed scoring system for non-IF publications

Author	Type of the journal			
	Non-IF indexed in Scopus	Recommended by the Committee for control in the field of education and science of the Republic of Kazakhstan	University journal	Other journal edited in Kazakhstan
first	5	4	3	2.5
second	3	2.5	2	1.5
remaining	2	1.5	1	1

Table 5. Proposed scoring system for conferences

Author	Conference type		
	National	regional (a level higher than national)	World/ Pan-Asian
first	1.0	1.5	2.5
second	0.75	1.0	1.5
remaining	0.5	0.75	1.0

The grant significance and the role of the candidate should be considered. However, without any doubt, their weight should not reach that of the first authorship in a good IF journal. Patents, certificates, diplomas should be categorized and their significance assessed (most likely no more than 1-2 point for each). The evaluation should rather limit the number of assessed achievements in each category.

The total score for research achievements obtained by a candidate could be considered as 20-40% of the available score in the grading system for admission to doctoral studies in subsequent calls (Table 6). The sum of points obtained for reseach activity should be recalculated (e.g. divided by 10 assuming that maximum expected points could count for 100 – see Tables 2-4 with subsequent comments).

Table 6 Revised 100-point grading system for admission to doctoral studies

Assessed item	Points	
	Option 1	Option 2
Essay	15	15
Test for readiness to study in the doctoral program	25	20
Exam on the profile of the group of the educational program	40	30
Research achievements	10	20*
Research plan	10	15
Total	100	100

* with a current proposal, candidates are highly unlikely to score 20 points (it is maximal, rather than the unexpected value)

5/ WKMOMU supervisor should be an active researcher with at least two to three IF publications with first or last authorship, respectively, pointing to own "reasonable" research activity or leading an active research team.

C/ PhD thesis pre-defense and defense procedures and responsibilities of "Problem commission" and "Dissertation Council"

The following proposals for improvement of the PhD procedures at WKMOMU aim to simplify them, make them more reliable and to avoid the overlapping of actions during different stages. The most important proposals are:

- limitation of the procedure to three stages,
- choice of more specialized Dissertation Councils that will consist of specialists in the given field of medicine with a scientific or academic degree,
- secret voting on every stage of procedure.

Here are some more details of the procedure of defense:

1) Presentation (pre-defense) at the open meeting of the Department (or Institute) with invited guests who are the experts in the topic of the dissertation. This procedure must be preceded by a comprehensive analysis and acceptation of the dissertation done by the supervisors/promoters. It is the responsibility of the supervisors to ensure and to confirm that the dissertation is ready for the pre-defense. During the meeting the candidate must be introduced by the local supervisor/promoter with special attention paid to the scientific activity, experience and previous publications. Then the candidate must present in details the PhD thesis (including assumptions and scientific hypothesis, the aim of the

study, materials and methods, results and conclusions). After the presentation, there should be an open discussion with the candidate, and all the experts should present their opinion with proposals of changes that can improve the manuscript. At the end of the meeting there should be a secret voting on the positive opinion of the Department Council. This voting should be done by those participants of the meeting who have a scientific or academic degree only. The protocol from the meeting should contain all the remarks of the participants, results of the voting and the final (positive or negative) opinion of the Council.

2) After a positive opinion given by the Department Council, the local supervisor/promoter should ask the Vice-Rector for Clinical and Scientific Work to send the final version of the PhD thesis to the Dissertation Council. There should be at least four (or more) different Dissertation Councils (or "Subcouncils") at WKMOMU:
   - for basic sciences,
   - for preclinical sciences,
   - for clinical surgical sciences,
   - for clinical non-surgical sciences.

   The Councils can be even more specialized (e.g., pediatric, surgical, internal diseases, etc.). Every Dissertation Council should consist of: an experienced scientist who will play the role of the Chairman and a few (e.g., 6-8) specialists in the given field of medicine who have a scientific or academic degree (scientifically active with unquestionable scientific achievements and recognized scientific authority), including at least two international members. Additionally, both supervisors (local and foreign) should take part in the work of the Dissertation Council. Each PhD candidate and the PhD thesis should be classified to an adequate Council. This Dissertation Council should proceed with the PhD thesis from the beginning to the final defense:
   - assessment of the formal requirements (such as: protocol with a positive opinion from the Department Board, bioethical committee opinion, anti-plagiarism testing results, conflict of interests declaration, list of publications, necessary exams, a manuscript of the dissertation, etc.);
   - assessment of the dissertation, eventual proposals for improvement, and choice of two external reviewers (out of WKMOMU) who are experienced scientists in the topic of the dissertation and have a scientific or academic degree;
   - preparation of the open defense;
   - during the open defense, the dissertation should be presented, the reviews should be read (possibly by the reviewers), and discussion with a candidate should be conducted with audience participation;
   - secret voting regarding the opinion on the dissertation and the course of defense should be carried out.

- the final protocol should contain all the remarks of participants, results of voting and a positive or negative opinion of the Council regarding the PhD degree acknowledgement.

3) On the basis of a positive decision issued by the Dissertation Council, the Scientific Council of WKMOMU votes on the conferring (or not conferring) the PhD degree,
4) The Committee for Control in Education and Science of the Ministry of Education and Science should be informed and play an appeal function. Besides, The Ministerial Committee could play a control function for all Universities.

The details and rules of action and their practical application on every stage of PhD thesis procedure, including the description of exact activities and obligations of the supervisors/promoters, Department Council, Dissertation Council and Reviewers should be thoroughly discussed (WKMOMU and International PhD Council).

D/ PhD study program and organizational issues

The final plan for improvement of medical education (both in medicine and public health) at the PhD level at WKMOMU, in general, should refer to ability to value difference and diversity, creativity and adaptability, as well as the ability to produce publications, grants and reports.

The action plan is divided into the following points:

A. A goal to be achieved,
B. Tasks/steps that need to be carried out to reach the goal,
C. People, who will be in charge of carrying out each task,
D. Deadlines,
E. Milestones in particular tasks,
F. Measures to evaluate progress.

A/ Description of the goal to be achieved

WKMOMU has developed a modular educational program for doctoral students in the area of medicine and public health. In the opinion of PUMS key-experts, the program should be corrected in order to enable the graduation of at least 6 PhD students each year (the first program to be started in 2022), who will conduct their research following international standards and close international cooperation.

B-D/ Tasks to be followed and the responsible bodies (see also Table 7)

1. Developing a permanent International PhD Council (team) of foreign researchers (at least 5 researchers with a doctoral degree or the title of professor, scientifically active with unquestionable scientific achievements and recognized scientific authority) who will
    a. be able to continuously correct and approve all the changes and improvements in PhD program and PhD courses at WKMOMU
    b. help in the recruitment of PhD students
    c. give opinions and approve individual research plans of WKMOMU PhD students
    d. participate in seminars and lectures which are given to PhD students
2. Introducing changes at the WKMOMU level defining the adequate requirements to be met by supervisors and international supervisors
3. Introducing changes at WKMOMU allowing for acceptance only candidates with good command of English or upgrading their English skills during the first semester
4. Changes in PhD program with an obligatory (or at least recommended) demanding completion of at least one semester of PhD studies in a scientific institution (laboratory) situated abroad (e.g., on the second year of PhD study)
5. Recruitment at least six doctoral students in 2022 (considering candidates from other Kazakh Universities as well as foreign candidates)
6. Selection of supervisors and international supervisors (preliminary short annotation ready)
7. Accepting individual research plans of PhD students (international supervisor should assist and be invited to all meetings during the whole procedure).
8. Conducting teaching of PhD students (in the period of 2022 – 2025), with annual reports
9. Public defense of a doctoral dissertation.
10. Graduation of PhD students (recruited in task no 6) in 2025.

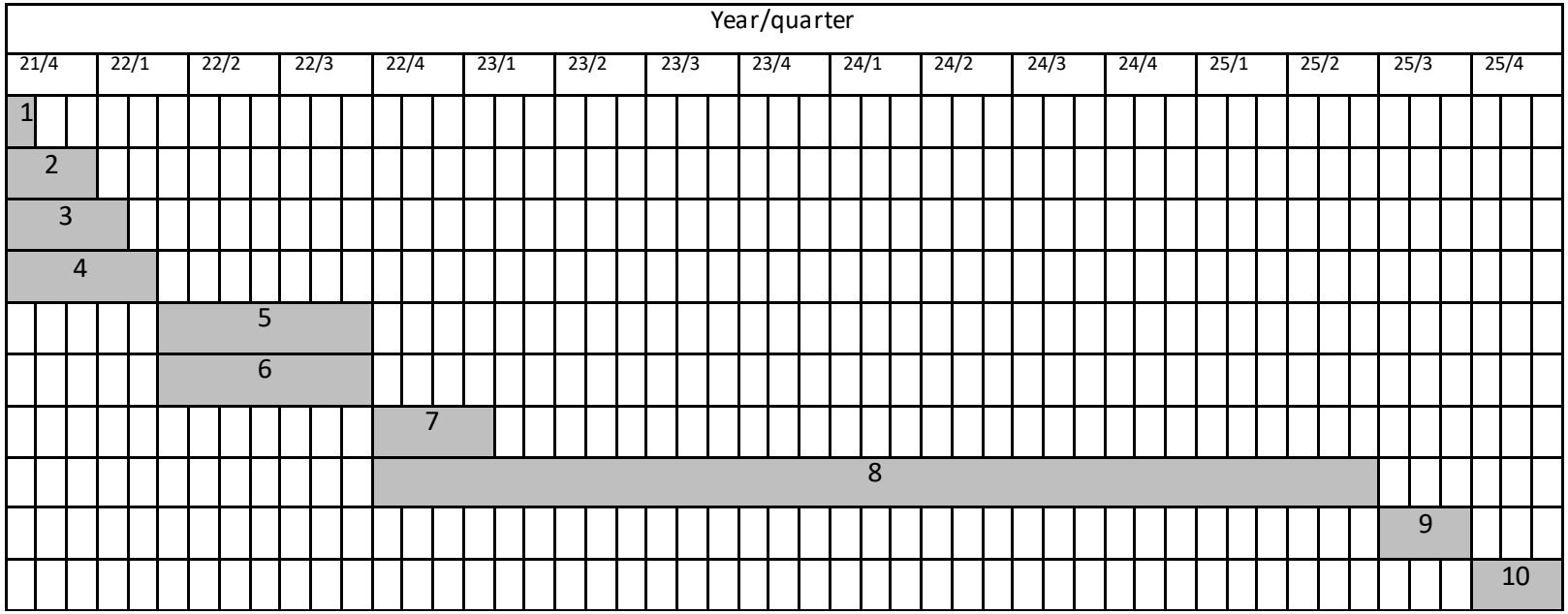
Table 7 Tasks to be followed and responsible bodies

Task	Assigned to	Due date
1	WKMOMU authorities	31st October 2021
2	WKMOMU authorities, International PhD Council	31st December 2021
3	WKMOMU authorities, International PhD Council	31st January 2022
4	WKMOMU authorities, International PhD Council	28th February 2022
5	WKMOMU authorities, International PhD Council	30th September 2022
6	WKMOMU authorities, International PhD Council	30th September 2022
7	WKMOMU authorities, International PhD Council	31st January 2023
8	WKMOMU authorities, WKMOMU employees, Supervisors, International supervisors, International PhD Council	30th June 2025
9	WKMOMU authorities, International PhD Council, Supervisors, International supervisors	3oth September 2025
10	WKMOMU authorities	31st December 2025

E/ Milestones (see also Figure 14)

1. Approval of International PhD Council – **31st October 2021**
2. Developing of final PhD program **– 31st January 2022**
3. Completion of all the legal procedures necessary to run the PhD program **– 28th February 2022**
4. Recruiting a minimum of 6 PhD students who will conduct their research in accordance with international standards and in close international cooperation **– 30th September 2022**
5. Designation of supervisors and international supervisors **– 30th September 2022**
6. Graduation of at least 6 PhD students who have conducted their research in accordance with international standards and in close international cooperation **– 30th September 2025**

Figure 14 Gantt chart for the action plan



F/ Monitoring, evaluating and updating of the action plan

By 28th February – preparing a report on the legal changes made to the PhD program at WKMOMU and presenting it to the International PhD Council and the WKMOMU Rector (the Department responsible for PhD program at WKMOMU with a supervision of appropriate Vice-Rector)

By 30th Sept 2022 – presenting the list of recruited PhD students to the WKMOMU Rector for final approval (Recruitment Commission with a supervision of appropriate Vice-Rector)

By 30th Sept 2025 - preparing a final report on the PhD program (the 2022 recruitment) and presenting it to the International PhD Council and WKMOMU Rector (the Department responsible for the PhD program at WKMOMU with a supervision of appropriate Vice-Rector)

By 31st December – final voting on conferring the Phd degrees (the Scientific Council of WKMOMU)

TASK 1B

"Building the capacity of academic staff and employees at the WKSMU (currently WKMOMU)"

SUBTASK 1B1

"Development of a competencies model of WKSMU (currently WKMOMU) teachers including the criteria to the system of selection, recruitment, training and evaluation of teachers"

Task Leader:	Prof. Maria Iskra
Subtask supervisor:	Prof. Maria Iskra
Key-experts:	Prof. Maria Iskra
	Assoc. Prof. Dorota Formanowicz
	Assoc. Prof. Szczepan Cofta
	Dr. Paweł Uruski
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	(1) Proposal of the system of selection, recruitment, training and the criteria of evaluation of the WKSMU (WKMOMU) teachers.
	(2) The report.

1.THE DEVELOPMENT OF A COMPETENCIES MODEL OF WKMOMU TEACHERS

The procedure of selection, recruitment, training and evaluation of teachers at the WKMOMU has been analyzed by PUMS experts, aiming to create the model of competency building of the academic staff at the WKMOMU and to improve both research and teaching activity.

The results have been presented in a form of recommendations passed to the WKMOMU authorities in the attached document.

On the basis of the documents received and the experience of PUMS experts obtained during their visit at the WKMOMU, the conditions of teachers' recruitment, employment, and teaching workload were analyzed in detail. The evaluation revealed a very complex system, not transparent, and not consistent with the expectations of both the teachers as well as the administrative staff. The WKMOMU staff is overloaded with very detailed and irrelevant regulations which are changed almost every academic year.

PUMS experts prepared new rules containing in their recommendations, taking into consideration the guidelines of the Ministry of Health of Republic of Kazakhstan, although allowing use the autonomous powers of the WKMOMU. The model of competency building for the WKMOMU teachers has been prepared by the following PUMS experts: Maria Iskra, Dorota Formanowicz, Szczepan Cofta and Paweł Uruski. This document includes the criteria for teacher selection, recruitment, training and evaluation.

Another important aspect has been to improve the research activity of the WKMOMU academic staff by changes in the workload of teachers at different positions, considering various types of academic positions and implementing the optimal evaluation period.

The model was presented to the WKMOMU authorities in February and March 2021 to explain all necessary details and to address all potential questions of both parties.

The model of competency building includes recommendations for the selection and recruitment of highly motivated candidates for teachers, training and evaluation of the academic staff based on transparent rules related to the duties and responsibilities, workload, promotion and development opportunities for each post.

The latest version of the suggested model (system) of teacher selection, recruitment, training and evaluation at the WKMOMU has been attached to the final report - the Attachment 1B1.

All steps in the development of the model were reported quarterly.

SUBTASK 1B2

"Participation of the partner University experts in the process of capacity building of teaching staff of WKMOMU according to the plan"

Task Leader:	Prof. Maria Iskra
Subtask supervisor:	Dr. Magdalena Cerbin-Koczorowska
Key-experts:	Prof. Maria Iskra
	Dr. Magdalena Cerbin-Koczorowska
	Dr. Paweł Żebryk
	Dr. Patrycja Stępak-Marciniak
Status :	100 % completion
Duration of activity:	June 2019 – December 2020
Output:	(1) Proposal of trainings for the capacity building of teaching staff and employees of the WKSMU (WKMOMU).
	(2) The report.

1.THE ANALYSIS OF METHODOLOGICAL PROCEDURES AT THE WKMOMU

Methodological procedures used at the WKMOMU in the course of the preclinical and clinical teaching has been analyzed by PUMS experts on the basis of the received documents from the Division of Administrative and Personnel Work, and Centre for Continuous Professional Development. PUMS experts analyzed the following teaching-related problems at WKMOMU:

1. Outcomes of the medical education according to current curriculum.
2. Methodological procedures used for the curriculum development in terms of the preclinical and clinical teaching.
3. Training methods for teaching staff at the WKMOMU including the number of teachers trained so far with the use of each method.
4. Assessment principles used in the analysis of teaching staff performance at the WKMOMU.
5. Teaching staff needs in terms of educational skills improvement.
6. Difficulties and limitations found by the teaching staff in the course of their training /preparation and practicing.
7. Difficulties found by the authorities of the WKMOMU in the course of the teaching staff preparation.

2.CYCLES OF TRAININGS FOR THE CAPACITY BUILDING OF TEACHING STAFF AND WKMOMU EMPLOYES

Two series of lectures, workshops, and/or seminars concerning the essential teaching issues were performed on-line by PUMS key-experts P. Żebryk, P. Marciniak-Stępak and M. Cerbin-Koczorowska in October and in November 2020.

The content of all classes was strictly based on the knowledge, skills and competencies regarding the teaching process of PUMS experts, in accordance with the modern education system functioning in the European Union.

The participation of a large number of the WKMOMU teachers in trainings should be appreciated (according to the obtained list– there were over 200 participants), we hope that the newly obtained knowledge will lead to enhancement of the WKMOMU perspectives and capabilities. It is unfortunate that no one from the WKMOMU attempted to take the final exam prepared as a follow-up activity by PUMS key-experts.

All lecture/seminar materials were submitted to the WKMOMU following each class.

The concept and plan of the WKMOMU teaching staff training started with a presentation concerning educational trends in the medical education („Introduction: a paradigm change in medical education"). A number of issues, such as a modern role of a medical teacher, Adult Learning Theory, Life-Long Learning, student engagement in learning, stages of mastering skills and reflective learning were discussed with the participants. Additionally, various models of

leadership and organizational change were introduced in the module „Leadership in medical education". The essential qualities of an authentic and effective leader, decision making in complex organizations and concepts of transformational and inclusive leadership were discussed. Participants were taught in small workshop groups how to implement changes to the curriculum, and actively discussed challenges in bringing about a change in the complex and traditional setting.

The „Professionalism" module addressed the importance of explicit teaching of professionalism to medical students. The workshop included a discussion on the view of professionalism, building a culture of professionalism, and paying attention to unprofessional behavior by students, academic staff or clinical colleagues.

Access to the literature was possible by the kind cooperation with the representative of the Elsevier company, and leading textbooks in the field of medical education were made available by Elsevier company free of charge to the WKMOMU staff.

Various aspects and assessment methods were introduced and discussed with the participants during the "Assessment" training. The strengths and weaknesses of each method were analyzed, and special attention was paid to the ability of learners to choose the optimal method to verify previously established educational goals. The experience of PUMS experts in assessing knowledge, skills and social competences, based on the internal best practices were also discussed.

The "Curriculum" module was oriented to the readiness of the learners to design the curriculum, based on the algorithms described in the literature. The individual stages of a program design, and trends as well as standards typical of medical education were presented and discussed in detail. During the workshop, the participants solved tasks and received feedback from the trainer.

It was also an opportunity to exchange experiences and identify the difficulties faced by PUMS in reorganizing the curricula and the methods by which these difficulties were overcome.

The valuable method for developing different skills was presented during "Feedback" training. Although introducing feedback requires modification of interaction with the student, due to an opportunity of an open dialogue, the teacher becomes more like a guide, whereas by developing self-reflection, students become more aware, active and responsible for their own education process. It has been highlighted that the key issue is to make feedback constructive - only then can it become a powerful motivator for the students. In terms of learners needs, practical models helpful in running feedback in the course of teaching sessions were presented and feedback limitations and risks discussed based on PUMS expert experience.

"Small vs. large group teaching" module (LGT) was focused on the methods helpful in making students more active in both – small, as well as large group teaching sessions. It was demonstrated that even small modifications to the structure and/or additional equipment/apps in LGT can motivate a larger number of students to a more active approach, and make this cost-

efficient method of teaching very effective. Communication skills of a teacher play a significant role in an impact of LGT and, therefore, should be constantly improved in the continuous self-development of a teacher.

The activity in the frame of subtask 1B2 was reported quarterly.

3.THE SCHEDULE OF TRAINING I AND TRAINING II HAS BEEN PRESENTED BELOW.

Training cycle I covered the following topics:

1. Introduction: a paradigm change in medical education – P. Żebryk
2. Professionalism – P. Żebryk
3. Leadership in medical education – P. Żebryk
4. Assessment (assessment of, for, and as learning, outcome-based assessment, assessment methods in medical education) part 1 – M. Cerbin-Koczorowska
5. Assessment (assessment of, for, and as learning, outcome-based assessment, assessment methods in medical education) part 2 – M. Cerbin-Koczorowska

Training cycle II covered the following topics:

1. Small vs. large group teaching. Part 1- P. Marciniak-Stępak
2. Small vs. large group teaching. Part 2 - P. Marciniak-Stępak
3. Curriculum (designing a curriculum, outcome-based education, hidden curriculum). Part 1 – M. Cerbin-Koczorowska
4. Curriculum (designing a curriculum, outcome-based education, hidden curriculum). Part 2 – M. Cerbin-Koczorowska
5. Feedback as a powerful tool for learning and developing skills. Part 1 - P. Marciniak-Stępak
6. Feedback as a powerful tool for learning and developing skills. Part 2 - P. Marciniak-Stępak

SUBTASK 1B3

"Development of the academic mobility program of for teachers at the WKMOMU and the partner University"

Task Leader:	Prof. Maria Iskra
Subtask supervisor:	Prof. Maria Iskra
Key-experts:	Prof. Maria Iskra
	Prof. Michał Nowicki
	Prof. Krzysztof Książek
	Assoc. Prof. Dorota Formanowicz
	Prof. Grzegorz Dworacki
	Prof. Maciej Krawczyński
	Prof. Dariusz Iżycki
	Assoc. Prof. Szczepan Cofta
	Dr. Łukasz Gąsiorowski
	Mgr Bożena Raducha
	Prof. Jacek Wysocki
	Prof. Tomasz Banasiewicz
	Dr. Barbara Kupczyk
	Prof. Aldona Woźniak
	Prof. Przemysław Guzik
	Assoc. Prof. Magdalena Leszczyńska
	Dr. Paweł Uruski
	Prof. Wojciech Leppert
	Assoc. Prof. Aleksandra Kotlińska-Lemieszek
	Assoc. Prof. Michał Karlik
	Dr. Magdalena Budzyń
	Dr. Bogna Gryszczyńska
	Dr. Magdalena Kasprzak
	Dr. Krzysztof Strzyżewski
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	(1) The proposal of the program (plan) of academic mobility of teachers of the WKSMU (WKMOMU) and partnering University.
	(2) 5 series of lectures, workshops, and/or seminars.
	(3) Training seminars/lectures/workshops materials.

1.THE DEVELOPMENT OF THE ACADEMIC MOBILITY PROGRAM FOR THE TEACHERS AT THE WKMOMU

The development of the academic mobility program for the teachers at the WKMOMU and the partner University was prepared by PUMS experts by means of the current knowledge in various medical disciplines.

The academic mobility program in medical disciplines provided the WKMOMU staff with the essential knowledge and skills necessary for their own development, as well as for the improvement of the WKMOMU education programs for both undergraduate and postgraduate students. The academic mobility program also enabled the WKMOMU administrative staff members to become familiar with the principles, rules and methods used by PUMS experts for the management of the academic mobility process, adequate for the cooperation with the European Union.

According to the project, the program of academic mobility was scheduled as 5 series of lectures, workshops, and/or seminars which held between January 2020 and February 2021. Training 1 was held at PUMS. Due to the Covid-19 pandemic, all other trainings were conducted online (Teams).

Lectures/workshops covered the following disciplines:

- basic: histology, biochemistry,
- preclinical: pathomorphology, pathophysiology, clinical biochemistry, laboratory diagnostics, clinical genetics,
- clinical: emergency medicine, pulmonology, oncology, cardiology, pediatrics, surgery, hypertensiology, palliative care, otolaryngology, phoniatrics,
- academic mobility and international cooperation issues intended for the administrative staff.

The training program for the academic staff has a structured phase approach, providing the knowledge for all the steps of medical education. Key-experts delivering lectures/workshops were high quality specialists in each discipline, and could share not only simple modern knowledge, but also their own professional experience. In terms of the basic disciplines (histology, biochemistry), the lectures contained also the recommendations concerning effective teaching methods in each discipline. The program topics were focused on several teaching issues which do not function well enough at the WKMOMU. All requirements in this matter were recognized and defined in the framework of task 1A1 and 1B1.

Trainings for the WKMOMU administrative staff was performed by a long-term experienced professional PUMS employee, the head of the Office for International Cooperation and European Integration – Bożena Raducha.

Each class had to be translated to Russian due to the insufficient English skills of the WKMOMU staff members.

Most lectures were followed up by discussions, exchange of opinions, additional questions to the lecturers, and visits to laboratories, the Medical Simulation Center and clinical departments at PUMS (before the COVID-19 pandemic). All questions and comments following the on-line classes were also submitted via e-mail or chat.

All lecture/seminar/workshops materials were submitted to the WKMOMU following each class

2.THE ACADEMIC MOBILITY PROGRAM WITH REGARD TO THE TOPICS

Basic disciplines

Histology– M. Nowicki

1. Contemporary histology. How to teach basic science effectively? Clinical cases in basic science. Problem-based learning - advantages and disadvantages. How to pass a histology course - point system. Questionnaire of students and academic teachers.
2. Virtual microscopy in the medical students education. Technical and technological conditions for virtual microscopy. Virtual microscopy in histology and embryology. Virtual microscopy and cooperation with the socio-economic PUMS environment.
3. Presentation of the didactic resources of the Department of Histology. Cytology and general histology.
4. The immune system, circulatory system, skin. Alimentary system.
5. Homeostasis (endocrine, respiratory, excretory system, sense organs).
6. Reproductive system.

Biochemistry – M. Iskra, M. Budzyń, M. Kasprzak, B. Gryszczyńska, K. Strzyżewski

1. Enzymes - properties, activity and application as diagnostic tools.
2. Electrolyte and acid-base balance in the human body.
3. Matrix metalloproteinases and their role in the human body.
4. Presentation of the didactic resources of the Department of General Chemistry.
5. Amino acids, properties and identification reactions.
6. Structure, properties and blood plasma proteins.
7. Properties and the physiological role of carbohydrates.
8. Properties and the physiological role of lipids.
9. Proteins as colloidal solutions.

Preclinical disciplines

Pathophysiology– K. Książek, B. Kupczyk

1. The rules and experimental tools in modern pathophysiology.
2. Pathophysiology of a disease at the cellular level.
3. Pathophysiology of the cellular senescence.
4. Pathophysiology of the nervous system.
5. Neurodegenerative diseases: Alzheimer's disease. Current view on the basic pathological processes, clinical symptoms and prognosis.
6. Neurodegenerative diseases: Parkinson's disease. Current view on the basic pathological processes, clinical symptoms and prognosis.
7. Pathophysiology of circulation. Hypercortisolism and hypocortisolism. Secondary hypertension.

Pathomorphology: - G. Dworacki, A.Woźniak

1. Non-neoplastic hematopoietic disorders: diseases of the white cells, lymph nodes and spleen part I.
2. Non-neoplastic hematopoietic disorders: diseases of the white cells, lymph nodes and spleen. Part II.
3. Non-neoplastic hematopoietic disorders: diseases of the white cells, lymph nodes and spleen. Part III.
4. Infectious diseases – morphology of the host tissue responses to infectious agents. Part I
5. Infectious diseases – morphology of the host tissue responses to infectious agents. Part II
6. Hypersensitivity reactions.
7. Kidney diseases. The role of a renal biopsy in patients with nephrotic syndrome.
8. Histopathological assessment of a kidney biopsy in nephrotic syndrome.
9. Immunopathology of glomerulonephritis.

Clinical genetics – M. Krawczyński

1. The principles and indications for genetic counselling.
2. Human chromosomes, their aberrations and methods of analysis. Clinical cytogenetics.
3. Genetic diagnostics of reproductive failure.
4. Methods and indications for genetic prenatal diagnostics.
5. Genetic causes of short stature.
6. Hereditary optic nerve atrophies.
7. Genetically determined retinal dystrophies.
8. Congenital malformations of the eye.
9. Genodermatoses - genetically determined skin disorders.

10. Prader-Willi syndrome and Angelman syndrome as models for the parental genomic imprinting.
11. Dynamic mutations and their clinical consequences.

Clinical biochemistry – M. Iskra, D. Formanowicz

1. Oxidative modification of lipids, proteins and nucleic acids.
2. Endo- and exogenic antioxidants as protective mechanisms against the oxidative stress.
3. Magnesium - its physiological functions, supplementation.
4. Biochemical basis of atherosclerosis, the growth of atherosclerotic plaque.
5. Metabolism of calcium and phosphorus. The importance of vitamin D in the human body.
6. Disorders of lipid metabolism in chronic kidney disease.

Laboratory diagnostics – D. Formanowicz

1. Biochemical risk factors for cardiovascular diseases.
2. Urinalysis as an example of laboratory diagnostics of body fluids.
3. Evaluation of renal function based on laboratory tests.
4. Point-of-care testing - the future of modern laboratory diagnostics.
5. The influence of life style components on the results of selected laboratory and anthropometric tests.
6. Laboratory diagnosis of inflammation and selected infectious diseases – analyzes based on selected clinical cases.

Clinical disciplines

Oncology – D. Iżycki

1. Imaging methods in oncology.
2. Fundamental definitions and assessment methods of the treatment results. RECIST.
3. Clinical studies. Prevention. Screening tests. Definition of prognostic and predictive factors.
4. The role of surgery in a multidisciplinary treatment: prevention, radical and palliative treatments.

Palliative care – W. Leppert, A. Kotlińska-Lemieszek

1. Holistic palliative and supportive care.
2. Organization of palliative care in the selected European countries.
3. Quality of life and quality of care assessment with validated tools.
4. Gastrointestinal and respiratory symptoms.
5. Dyspnea.

6. Chronic nausea and vomiting, pathophysiology and treatment.
7. Pathophysiology, clinical assessment and treatment of chronic pain.

Pulmonology – S. Cofta

1. Sleep disturbances in the clinical practice.
2. Obstructive respiratory disorders.
3. Cystic fibrosis and rare pulmonary diseases.

Hypertensiology – P. Uruski

1. Hypertension definition, classification, pathophysiology and treatment.
2. Arterial hypertension – current guidelines.
3. Hypertension in pregnancy.

Cardiology – P. Guzik

1. Preparing cardiac patients for a non-cardiac surgery.
2. Cardiac problems in patients with a stroke.
3. Sports cardiology.

Pediatrics – J. Wysocki

1. Current picture in infectious diseases in children and the possibilities of prevention.
2. The basic rules of creating the National Program of Immunizations. Prevention of infectious diseases based on the NPI.
3. Immunizations important for adults – the needs and implementation.
4. Teaching of pediatrics using current standards.
5. The basic pediatrics topics essential for the General Pediatrician. The milestones of medical care of a healthy infant.
6. The most common infections of children between 1 and 3 years of age.
7. Healthcare of a child at school age – the principles in the student's education.
8. How to use medical standards and recommendations in the daily pediatric practice.

Surgery – T. Banasiewicz

1. The complex perioperative treatment - how to prepare the patient for surgery.
2. Negative pressure wound therapy.
3. Surgical site infection.

Thoracic surgery – Ł. Gąsiorowski

1. Principles of diagnostics and management in the Thoracic Surgery.

2. Thoracic Surgical aspects of Lung Cancer – principles. Minimally invasive thoracic diagnostic procedures.
3. Minimally invasive thoracic diagnostic procedures diagnostic bronchoscopy, cryobiopsy. Minimally invasive thoracic diagnostic procedures – EBUS and radial probe.
4. Minimally invasive thoracic surgery.

Otolaryngology – M. Leszczyńska

1. Trauma of the ear, nose, throat (ENT).
2. Emergencies in ENT.
3. Nasal obstruction. Nose and paranasal sinuses pathology.

Phoniatrics – M. Karlik

1. Hearing pathology. Diagnostic techniques in audiology.
2. Prevention, treatment and rehabilitation of hearing impairment.
3. Risk factors for sensorineural hearing loss.

Emergency medicine – Ł. Gąsiorowski

1. Simulation Based Medical Education – Scenarios and debriefing.
2. Simulation in medicine – why there is no turning back! The principles of creation of simulation scenarios part I – how to create a simulation scenario in an effective manner?
3. The principles of creating simulation scenarios part II – how to conduct safely and effectively a simulation scenario.
4. The art of debriefing - part I (Pre-briefing & debriefing).
5. The art of debriefing - part II (video-based debriefing and what can go wrong).
6. Simulation Based Medical Education – Simulated Patients and Crisis Resource Management. Teaching teamwork and crisis resource management.
7. Patient Safety and Non-Technical Skills.
8. The principles of creating simulation scenarios in terms of non-technical skills.
9. Simulated Patients – a new tool in medical simulation.

Trainings for the administrative staff – B. Raducha

1. Mobility as an important element of internationalization. Cooperation as the main element conditioning mobility.
2. Internal solutions regulating mobility (lecture and workshops):
    - academic mobility procedures at PUMS, regulations regarding employee mobility
    - comparing the rules used in both universities,
    - strengths and weaknesses of the already existing solutions

- suggestions for the changes to simplify the rules in accordance with the applicable legal regulations
- the role of administration in creating internal solutions

3. Mobility management (lecture and workshops):
   - substantive aspects (goal of mobility), intercultural (cultural differences) and financial (mobility budget)
   - the role of administration in mobility management and examples of activities supporting the activities of the university authorities
   - mobility of administration and the academic staff - how to identify the needs
4. *Preparation of suggestions for the solutions facilitating mobility and analysis of the possibilities of their implementation in the time perspective.*
   - the analysis of WKMOMU academic mobility procedures
   - the analysis of WKMOMU academic mobility-related documents and comments for the academic mobility rules improvement
   - discussion and analysis of the WKMOMU rules regulating mobility of students and teachers. Consultations for the WKMOMU administrative staff concerning the current and complex problems.
5. How to get a PIC number (the unique Participant Identification Code), what is it and why is it needed?
6. Practical exercises in writing an example of a mobility application for the ERASMUS Program - reading the application guide and finding the essential information.
7. Practical exercises in the field of writing an example of a mobility application. Collecting data for a sample of Erasmus. Bilateral agreement and its completion.
8. Practical exercises in writing an example of a mobility application - preparation the budget.

SUBTASK 1B4
"Development of training programs for teachers in online certification courses offered at the partnering University"

Task Leader:	Prof. Maria Iskra
Subtask supervisor:	Dr. Beata Buraczyńska-Andrzejewska
Key-experts:	Prof. Maria Iskra
	Dr. Beata Buraczyńska-Andrzejewska
	Dr. Łukasz Gąsiorowski
	Dr. Ewelina Swora-Cwynar
Status :	100 % completion
Duration of activity:	June 2019 – February 2021
Output:	(1) e-learning courses: a cycle of training in teaching methodology and 2 on-line cycles of training in medical disciplines
	(2) Training seminars, lectures, and/or workshop materials.
	(3) Report

1.THE ANALYSIS OF WKMOMU NEEDS CONCERNING ONLINE COURSES

The main goal of the task was the introduction of the training program for teachers and academic staff of the WKMOMU by using the innovative methods and technique s offered by PUMS. The cycles of trainings were prepared.

The extended analysis of WKMOMU needs concerning the detailed subjects of online courses was performed by PUMS key-experts visiting the WKMOMU. The equipment and IT technology available at WKMOMU online center were evaluated considering the possibility of the innovative training programs introduction.

PUMS experts, Maria Iskra and Beata Buraczyńska-Andrzejewska met WKMOMU specialists from:

- the Center for Continuing Professional Development and the Center organization, methodology of conducting on-line courses, forms of classes realized, on-line exams type, were presented by WKMOMU staff
- the Simulation Center and its equipment, methodology of conducting classes with use of simulations, were presented by WKMOMU staff
- Test Centre and its equipment, technical conditions, software, methodology of preparing and conducting exams, methodology for the assessment of reliability were presented by the WKMOMU staff

The following needs were identified:

1. the necessity to improve the functioning of the Moodle e-learning platform by installing appropriate software allowing the proper display of e-learning materials prepared in SCORM packages using Articulate software,
2. the necessity to expand the offer of active e-learning materials at WKMOMU, the materials provided to WKMOMU students and staff by the Center were prepared in the usual pdf format and used as downloadable files. It was not a real e-learning technology,
3. lack of e-learning training courses regarding the methodology of preparing materials for online learning,
4. lack of arranging the formative and summative evaluation scores,
5. lack of describing the quality of the examination questions by specifying the degree of difficulty and discrimination,
6. lack of creating the examination matrix.

The assistance of PUMS key-experts in developing the WKMOMU e-learning capabilities according to the needs mentioned above:

1. between January 2020 and January 2021 the WKMOMU did not employ any staff competent in the matter above. PUMS key-experts provided comprehensive assistance including on-line consultations, access to PUMS e-learning platform to identify the technical issues, recommendations concerning software necessary for the improvement, nevertheless, until January 2021 there had been no employee at the WKMOMU who would have been able to implement PUMS assistance in practice. In March 2021 WKMOMU staff declared that all of the e-learning materials were received by the WKMOMU, and that they worked properly.
2. all e-learning materials provided by PUMS key-experts were prepared according to the specifically designed forms, taking into account the activation questions and feedback. Each material had a set pass threshold, which allowed for monitoring of the learning progress.
3. e-learning course on e-learning methodology was prepared by PUMS key-experts which took into account types of e-learning materials, their proper preparation; this course contained also numerous international publications concerning e-learning preparation, as well as links to both computer programs, which were used to prepare the course and which are helpful for the preparation of the e-learning materials. The course in total contained numerous inspirations for creating active and effective e-learning materials.
4. e-learning methodology course provided by PUMS contained the assessment section. Particular attention was paid in the course to indicate all differences between the formative and summative assessment.
5. e-learning methodology course in its assessment chapter indicates the need and methodology for the proper description of exam questions and their use in the design of matrices.
6. e-learning methodology course in the assessment chapter indicates the methodology of matrix design taking into consideration learning outcomes.

2.THE PROGRAM OF E-LEARNING COURSES PROVIDED TO WKMOMU

The program of e-learning courses provided to WKMOMU in the framework of the task 1B4 is intended for the WKMOMU staff members of various specialties, PhD students and residents.

The e-learning cycle "Methodology of e-learning teaching".

1. Learning outcomes in e-learning – why and how.
2. How do adult learners learn?
3. Methodology of preparing e-learning materials.
4. Types of activities.
5. E-assessment.

Preparation: B. Buraczyńska-Andrzejewska
Supervision: M. Iskra

The e-learning course "Emergency medicine" covering both, teaching methodology and medical discipline issues – emergency medicine:

1. Emergency resources management and patient safety.
2. Simulation Based Medical Education

Preparation: Ł. Gąsiorowski
Supervision: M. Iskra

The e-learning courses "Dietetics" covering the modern knowledge in the medical discipline – dietetics:

Part I

1. Interactions and competition within the microbial community of the human colon.
2. Nutrition during pregnancy.
3. Nutritional education in various target groups. Microbiota – self-test.

Part II.

4. Gastro-esophageal reflux disease.
5. Irritable bowel syndrome.

Preparation: E. Swora-Cwynar
Supervision: M. Iskra

All training seminars, lectures, and/or workshop materials were submitted to the WKMOMU as e-learning attachments. All steps were reported quarterly.

Task 1C. "Development of institutional research capacity of the WKMOMU"

SUBTASK 1C1
„Assistance in the establishment of research laboratories through training of the employees and provision of methodological support with subsequent implementation"

Task Leader:	Prof. Jarosław Walkowiak
Subtask supervisor:	Prof. Agnieszka Malińska
Key-experts:	Prof. Grzegorz Dworacki
	Prof. Krzysztof Książek
	Prof. Agnieszka Malińska
	Prof. Jarosław Walkowiak
	Assoc. Prof. Witold Szaflarski
	Dr. Magdalena Frydrychowicz
	Dr. Anna Wawrocka
	Dr. Katarzyna Wołyńska
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	(1) Report with the description of mentoring and training activities.
	(2) Established laboratory.

1. THE DESCRIPTION OF MENTORING AND TRAINING ACTIVITIES

The project implementation scenario included an extensive series of training courses to be conducted both at WKMOMU and PUMS research laboratories. Unfortunately, due to the epidemiological situation, the project architecture needed to be adjusted, which resulted in online training and workshops. It should be noted that each time the communication channel was adapted to the nature of the issues discussed, and every effort was made to ensure that the change of the training mode did not affect the training's substantive quality.

The series of training conducted as part of the project was focused on three main methodological trends, the selection of which was closely related to the defined profile of research laboratories:

1. Molecular Biology and Genetics Techniques
2. Immunohistochemistry
3. Flow Cytometry

Molecular Biology and Genetics Techniques

In October 2019, PUMS key-experts Agnieszka Malińska and Witold Szaflarski visited WKMOMU to undertake activities related to the provision of appropriate equipment in laboratories. Their visit to a central laboratory identified methodological errors in the process of DNA isolation. For this reason, training was carried out to correct the mistakes and optimize this research method. Besides, a number of direct training sessions were also organized on how to conduct molecularchemical reactions and analyze qPCR thermocycler results. The training brought many benefits.

Due to the epidemiological situation, WKMOMU employees' and PUMS experts' visits to the partnership University were not possible. Therefore, the remaining workshops and training (both theoretical and practical) were conducted online as lectures, seminars and exercises.

The training in Molecular Biology and Genetics Techniques covered the following topics:

I. **"Laboratory techniques and biochemical calculations in DNA, RNA and protein research**." **(January 2020, June 2020, December 2020, March 2021)**
   1. Introduction to molecular genetics techniques
      - Introduction to molecular techniques and their practical application, including PCR and its variants, MLPA, QF-PCR, microarrays, Sanger sequencing, Next-Generation sequencing – theoretical basics
      - Demonstration of the equipment used in the lab while doing discussed analysis
      - Discussion of types of genetically determined diseases and types of mutations
      - Demonstration of the possible results of molecular techniques with an explanation

- Explanation of diagnostic strategy in genetically determined disorders,
- Practical exercises
- Introduction to the description of sequence variants according to HGVS guidelines with exercises.

2. Working with RNA and proteins
   - Discussion of RNA sequence databases; exercises on example genes (MVP, TEP1, vPARP); exercises on selected fragments of non-coding RNA (vtRNA1-1)
   - Distinguishing between RNA and protein sequences in the database (searching for housekeeping genes and sample genes tested, e.g. Ki67)
   - The work with the SnapGene program
   - A brief demonstration of cell cultures so that everyone can understand where the DNA, RNA and proteins come from for research.
3. Isolation of DNA
   - DNA extraction methods - theoretical introduction
   - Demonstration of all needed equipment
   - A short pipetting course with practical exercises
   - DNA isolation from the buccal cells with a column-based method – all steps demonstration
   - Presentation of the automated workstation for nucleic acid extraction – MagCore(RBC Bioscience)
   - DNA isolation from the blood with an automated MagCore system – all steps demonstration
   - Principles of checking quantity and quality of DNA with different techniques (agarose gel electrophoresis and NanoDrop measurement) – practical exercises.
4. PCR reaction and principles of health and safety at work in the laboratory
   - Introduction to PCR reaction (what is replication process, types of PCR reactions, PCR ingredients, steps, the equipment used for PCR with showing what is necessary for PCR in a lab)
   - PCR reaction preparation and setting the reaction in the thermocycler. Discussing the principles of reaction submission and how to program a thermocycler (how to choose the right temperatures for each cycle and the number of cycles)
   - Primers design. How to design primers for PCR reaction: a short reminder about the principles of primer design, primer design "by hand". Discussion of the conditions that primers should fulfill so that they are complementary only to the DNA fragment of interest (showing programs and databases), explanation of the melting temperature and the content of GC pairs in the designed primer. Primers design with the use of computer programs (Primer3Plus) and databases (Genome Browser, Ensembl).

5. Isolation of RNA
   - RNA isolation by two methods - columnar and TRIzole
   - Demonstration of all needed equipment
   - Light spectroscopy methods for RNA determination in buffers, measurement of RNA concentration using spectroscopic techniques (e.g., Biotek Synergy 2 - is in WKMOMU).
6. Electrophoresis in polyacrylamide gels (PAA)
   - Demonstration of electrophoresis – all steps in this process
   - What is separation?
   - Vertical electrophoresis in PAA gels
   - Demonstration of the electrophoresis system from Bio-Rad
   - Work with the gel documentation system
   - Examples of the separation of universal markers
   - the separation of the total protein fraction
   - Staining with the Ponceau method S
7. Primers design for RNA detection
   - Designing of primers for assessment of gene expression using qPCR and Northern and FISH on the example of MVP, TEP1 and vPARP genes and vtRNA 1-1
   - Working with software such as SnapGene, Primer3.
8. RT-PCR reaction
   - Demonstration of conducting PCR reactions for determination of gene expression
   - Housekeeping genes (GAPDH, ACT, rpL30, HPRT) and test genes (MVP, ATF3, ATF4)
   - Modulation of gene expression after administration of cytostatics (e.g. vinorelbine)
   - Demonstration of running agarose gel electrophoresis with Housekeeping genes (GAPDH, ACT, rpL30, HPRT) and test genes (MVP, ATF3, ATF4).
9. RT-QPCR reaction / qPCR interpretation results and performing the reaction
   - Conducting the qPCR reaction
   - QPCR (Ct) calculations for relative assessment. Examples were taken from the previous meeting (GAPDH, ACT, rpL30, HPRT, MVP, ATF3, ATF4)
   - Modulation of gene expression after administration of cytostatics (e.g. vinorelbine) – exercises and working with Ct calculations.
10. Protein isolation
   - Protein isolation – TRIzol and column method
   - Demonstration of isolation of protein from cancer cells using the column method
   - Demonstration of a quantitative assessment of total protein by the Bradford method.
11. Electrophoresis in agarose gels

- Theoretical introduction regarding the principle of operation, types of electrophoresis, types of gels and their application, ingredients for the preparation of agarose gel (showing everything in the laboratory). An explanation of what is the size marker and loading buffer for electrophoresis and what they are used for. An explanation of how to select the percentage of agarose gel for the size of the DNA fragment to be separated
- Preparation of a 1.5% agarose gel for separation of previously prepared PCR products
- Separation of PCR products on the gel - the preparation of the PCR products for the recovery of the gel and electrophoresis
- Analysis of results after electrophoresis and an exercise in determining the size of PCR products after comparison with the size marker
- Preparation of PCR products for Sanger sequencing - purification, preparation of the reaction mixture.

12. BRCA1 - genetic predisposition to breast and/ or ovarian cancer (5382insC - ex.20, 4153delA - ex.11, C61G - ex.5), using allele specific PCR (PCR-ASA) and PCR-RFLP methods
    - Explanation of the PCR-RFLP reaction, the restricting enzymes and the selection of an enzyme when looking for a mutation. Overview of PCR-ASA and the use of both methods in the identification of 3 mutations in the gene BRCA1
    - Preparation of the PCR reaction for a fragment of the BRCA1 gene
    - PCR reaction
    - Digestive enzyme for digestion of PCR products
    - Electrophoresis in agarose gel
    - Analysis of results.
13. Clinical and genetic databases and determining the risk of mutation inheritance (types of Mendelian inheritance)
    - Databases: Orphanet, Face2Gene, Unique, NORD, NCBI (PubMed, OMI M)
    - Exercises - searching for selected publications, clinical information on specific genetic diseases and type of inheritance. Searching for information on a gene (OMIM)
    - Presentation of Mendelian inheritance types and exceptions, patterns and crosses
    - Classes of inheritance based on clans of the shoot, drawing a pedigree based on family history.
14. Work with genetic databases (part 1)
    - Presentation of the most common DNA databases: NCBI , Ensembl , Genome Browser

- Showing the most used features of presented databases: comparing genes across the species, finding information about the gene structure and sequence, finding SNPs and other variants in a gene, checking gene expression in different tissues
- Practical exercises – searching for information in DNA databases
- Presentation of the most common protein databases: HPRD and UniProt with a demonstration of most useful options: protein structure, protein domains, protein sequence, comparing proteins across the species, 3D protein models
- Practical exercises – searching for different information in protein databases.

15. Work with genetic databases (part 2)
    - Presentation of the most common databases for mutations and polymorphisms: dbSNP, HGMD, cosmic
    - Practical exercises – finding information about genetic variants in the gene of interest
    - In silico analysis with 5 prediction softwares (SNP&GO, Mutation Taster, SIFT, PolyPhen, Panther) to assess the impact of different mutations
    - Introduction to the CodoneCode Aligner – software for sequencing analysis and DNA assemble
    - Analysis of the sequencing results – practical exercises
    - From DNA in the PCR tube to patient's results – step by step analysis using all demonstrated databases.
16. Practical training devoted to DNA isolation and extraction, agarose gel electropohoresis and Real-Time PCR
    - Preparing the reagents for DNA isolation, DNA extraction from blood by using Thermo Scientific kit, assessment of the amount and quality of DNA in an agarose gel and spectophotometer
    - Preparation of the gel, DNA electrophoresis
    - Preparation of laboratory practice manuals and list of reagents necessary for DNA isolation and electrophoresis
    - Introduction to Real-Time PCR, performing the reaction, analysis of results
    - Joint analysis of sequencing results in CodoneCode Aligner (free online version).
17. Implementation of proteomic techniques related to the western-blot method
    - The possibilities of isolating proteins from both in vitro cultured cells and blood
    - Preparation of individual buffers in the Western-blot technique
    - The protein quantification technique based on BCA technology
    - Joint analysis of sequencing results in CodoneCode Aligner (free online version)
    - The principle of using and selecting complementary primary and secondary antibodies in the detection of proteins in the membrane associated with the Western-blot technique.

II. "Enzyme-linked immunosorbent assay" (January 2020, December 2020)

1. Lectures:
   - Characterization of various types of ELISA assays (including direct, indirect, sandwich, and competitive ELISA)
   - Advantages and disadvantages of various ELISA types
   - ELISA troubleshooting
   - Analysis of ELISA protocols for selenoprotein P (the protein of interest for WKMOMU scientists)
   - Analysis of the biocompare.com internet platform as a tool for effective identification of specific ELISA reagents, assays, and consumables
   - Analysis of exemplary ELISA protocols from different manufacturers.
2. Laboratory training
   - Presentation of devices and consumables required for ELISA
   - Advantages and disadvantages of different types of plate washing (manual, semi-manual, automatic)
   - Presentation of DuoSet ELISAs (using dedicated assays from R&D Systems) for IL-8 and VEGF in human serum samples and conditioned medium from cell cultures
   - Preparation of standard curves and serial dilutions of the samples
   - Establishment of protocols of ELISA using plate reader Synergy H1
   - Analysis and interpretation of ELISA results
   - Assistance for WKMOMU scientists to establish their own ELISA protocol in Synergy plate-reader localized at the WKMOMU.
3. Practical training "ELISA method's principles and practical aspects of its use"
   - Detailed analysis of manufacturer's instructions regarding ELISA-based assays for MPO, VEGF, VEGF-R1, VEGF-R2, FMS-like tyrosine kinase, PLGF, and IL-6. Particular attention was paid to quantities of consumables required to perform each assay, preparation of standard curves, calculations of concentrations of certain chemicals (antibodies, strepravidin-HRP), a selection of working dilutions of serum samples, calculations of results obtained using an in-device software, and Excell, troubleshooting
   - A training regarding the usage of a Synergy plate-reader, including an establishment of protocols for specific ELISAs, selection of reading parameters, and data export and storage.

Since the workshops' participants showed great interest in the presented research techniques and repeatedly proved their commitment, it seems that WKMOMU employees will continue research in the field of molecular biology. The proof of our assumptions is the currently conducted analyses of gene's polymorphisms performed independently by the employees of WKMOMU. However, it should be noted that the value of our workshops and training courses

could significantly increase, if not for the unacceptable waiting time for reagents. Consequently, in a significant part of the workshops, the employees of WKMOMU were forced to act as passive observers. It is a pity that the university authorities did not make effort to ensure that the activities, planned two years earlier, bring the maximal theoretical and practical benefits for WKMOMU.

Immunohistochemistry (Decemebr 2020, January 2021, February 2021, March 2021)

A series of lectures and practical trainings dedicated to immunohistochemical analysis in scientific research was prepared and conducted. The reason for focusing on the above research method was analyzing the current state of the equipment and research reagents at the WKMOMU University in Aktobe.

1. Lectures:
    - Immunohistochemistry - Priciples and Applications
    - Immunohistochemistry - Tips and explanations
    - Immunohistochemistry - How to design Your IHC Experiment?
    - Immunohistochemistry - Troubleshooting Guide
    - IHC results – how to measure?
    - IHC results – how to sell it?
2. Practical training sessions
    - Immunocytochemistry – past, present or future? - Technical workshop focused on the technique of immunohistochemistry
    - IHC step by step - PUMS experts present all steps of the IHC procedure (Skype and WhatsApp). The method's presentation took place in real-time, and its primary goal was to prepare the WKMOMU employees to work independently with the IHC technique. The final stage was the analysis of the results obtained and the validation of the antibodies used
    - IHC let's make it together! In the second stage, the IHC reaction was conducted simultaneously by a PUMS expert and a WKMOMU employee. The training was held in constant online contact
    - IHC by your own - The last stage was the independent laboratory work of an employee of WKMOMU under a PUMS expert's supervision. The final task of the WKMOMU employees was the interpretation of the results of the IHC reaction.

Taking into account the fact that the aim of the activities undertaken by the contractor of the project is not only to achieve the fundamental goals defined in the project but also to care for the proper course of the scientific activity of the WKMOMU team, several discussions were also held during the workshop. The potential use of the obtained results in further research works and

the possibility of correlating the level of protein expression with clinical data were discussed. The discussion panel also included issues related to enriching the obtained results with the analysis of proteins' expression from the cytokeratin family. The last stage discussed the methods associated with interpreting the results of the IHC reaction, the use of the Remmele scale, and the need to enrich the test results with positive and negative controls.

Since the first obtained results were not entirely satisfactory, the incubation time and the counterstain method were optimized. The final results of the IHC reaction are satisfactory and prove the good methodological preparation of the WKMOMU team.

Because laboratories already have the essential equipment, it seems that the implementation of immunohistochemical tests is only a matter of scientists' involvement.

Flow cytometry (January 2020, September 2020, October 2020, December 2020, March 2021)

"Flow cytometry – principles and basic applications in biomedical sciences" was dedicated to getting acquainted with basic principles and technical issues of flow cytometry.

1. Lectures:
    - Construction and types of flow cytometers
    - Optics
    - Fluorochromes
    - Types of immunofluorescence reactions
    - Fixation and permeabilization
    - The role of cell gating
    - The role of forward and side scatters
    - An exemplary analysis of flow cytometry results in a different population of leukocytes
    - Flow cytometry troubleshooting
    - Presentation of ModFit and GUAVA software for DNA flow cytometry analysis.
2. Seminar:
    - The principles of the preparation of biological material for flow cytometry in cell culture.
3. Practical training part I:
    - Presentation of a cell culture laboratory equipment and basic consumables
    - Methods of cell harvesting, counting, fixation, and permeabilization
    - A training on how to manage with cells in sterile conditions
    - Experiments on cell cultures in sterile conditions; change of medium; cell passage; cell counting using the Bürker chamber
    - Principles of the establishment of primary cell cultures from human tissues: isolation of peritoneal mesothelium and peritoneal fibroblasts
    - Demonstration of cell storage (freezing and defrosting) in liquid nitrogen.

4. Practical training part II:
    - The presentation of direct and indirect immunofluorescence reactions
    - Surface staining for specific antigens
    - The washing of bone marrow samples for the staining of surface immunoglobulins and its light chains
    - The performance of a blood smear in the flow cytometer software and its initial assessment
    - Staining of surface antigens in the cerebrospinal fluid
    - Presentation of flow cytometry of solid tissue (homogenisation of the lymph node)
    - Investigation of the phagocytic function of granulocytes and monocytes in whole blood by flow cytometry
    - The preparation of blood from an HIV positive patient for the flow cytometry procedure.
5. Practical training part III:
    - The principles for flow cytometry
    - Flow cytometry data analysis in the diagnostics of acute lymphoid and acute myeloid leukemias
    - The analysis of flow cytometry results in the diagnostics of myeloproliferative disorders, acute lymphoid leukemias, acute myeloid leukemias, lymphomas, and immunodeficiencies
    - The application of the flow cytometry for scientific experiments and diagnostic procedures, such as preparing biological materials and a measure of the following antigens distribution in the peripheral blood: CD45, CD14, CD3, CD19, CD4, CD8, HLA-DR, CD16, CD56
    - Flow cytometry diagnostic analytical procedures used for WKMOMU patients with acute lymphoid leukemia or with secondary immune deficiency
    - Tutoring in flow cytometry analysis considering acute lymphoid leukemia or with secondary immune deficiency.

We suppose that there is no real interest in flow cytometry training at WKMOMU. The first blood sample analysis, which was not the element of the training provided by a cytometer distributor, was done with PUMS experts supervision. WKMOMU authorities delegated only one person for the training in the frame of the project. It should also be emphasized that there were no questions and no interest in response to a lecture concerning flow cytometry held by key-expert Grzegorz Dworacki, who was invited by the Head of Microbiology, Virology and Immunology Department to share his knowledge during the conference organized by WKMOMU. Moreover, the Head of the Department of Microbiology, Virology and Immunology does not have sufficient competencies in immunology – for the last few years she was only an employee of administrative department having no relationship to immunology. Considering what has been

mentioned above, we are afraid that the modern cytometer will not be adequately used with a loss of WKMOMU scientific possibilities. We recommend WKMOMU authorities to support all employees who will be really interested in flow cytometry and continuous work with the use of this equipment. WKMOMU staff members should start and continue their education (which could begin for many WKMOMU employees in the frame of the project). They should be sent by the WKMOMU authorities to good flow cytometry labs (all over the world or at least preliminarly to strategic partner) for a few months with a proper emphasis being put at least on the practice of the flow cytometry analysis.

2. ESTABLISHED LABORATORY

The foundation that is necessary for the university's scientific activity's proper functioning is: 1) scientific staff with substantive knowledge in the field of using research methods for the implementation of scientific research and 2) modern research equipment and profiled research laboratories. Therefore, during the project's implementation, activities were undertaken to support both areas.

It seems clear, that achieving success requires a broad perspective - taking into account not only the trends in the modern world of science but also a compilation of research interests of WKMOMU employees, financial possibilities determining the equipment of laboratories, and the current strategic programs of the Ministry of Healthcare of the Republic of Kazakhstan. Defining the direction of activities aimed at organizing research laboratories in the first phase was based on the analysis of the content of the reports created by a PUMS expert who fulfiled the duties of the Vice-Rector of Strategic Partnership in the WKMOMU since March 2018. Based on the data contained in the reports of PUMS experts, the research topics of internal projects implemented at WKMOMU were verified, and the research potential and research interests of WKMOMU employees were analyzed.

Since WKMOMU does not have fully equipped research laboratories that could ensure autonomy in scientific research, PUMS experts decided to continue the directions of activities suggested in the reports aimed at organizing a molecular biology laboratory and a morphological laboratory. The decision was made based on the following factors: 1) the above laboratories' equipment is relatively cheap, 2) the research techniques underlying the functioning of these laboratories are not complicated and constitute an excellent foundation for further development, 3) molecular biology techniques and immunohistochemical reactions can be used in an extensive range of research. An unspeakable advantage of this approach is that WKMOMU will have laboratories whose scientific potential can be implemented in many research projects, both in basic and clinical sciences.

The equipment of leading PUMS laboratories, which deal with research in molecular biology, medical genetics, microbiology, metabolism and nutrition, morphology and

immunohistochemistry, was also analyzed (Attachement_1 SUBTASK 1C1). The prepared list of equipment allowed to develop a list of research equipment necessary to conduct basic research in line with the employees' interest in WKMOMU.

The critical stage leading to the finalization of activities related to WKMOMU laboratories' organization was the PUMS employees' (Witold Szaflarski and Agnieszka Malińska) visit in Aktobe (October 21st, 2019 - October 25th 2019). Detailed verification of the progress of the purchase of reagents and laboratory equipment was carried out. During the visit, every effort was made to identify problems associated with the process of purchasing equipment for laboratories: 1) Problems related to tender processes with the WKMOMU purchasing department were discussed, 2) The current state of the organization of laboratories and the level of their activity were verified with chief of the Department of Science - Gulmira Zhurabekova, 3) The current status of purchases of reagents necessary for the proper functioning of the morphological laboratory was verified. For the sake of the successful implementation of the project, problems regarding the tender process for equipment dedicated to WKMOMU laboratories have been presented to Head of PMU, National Project Coordinator, MPA Bolat Tokezhanov.

To present and discuss project implementation problems, a PUMS representative actively participated in the Strategic Partner Conference in Nur-Sultan (October 24th – 25th, 2019).

Conclusions from the experts' stay at WKMOMU, the definition of risk factors and the status of the organization of laboratories contributed to the organization of a series of online consultations by Professor Jaroslaw Walkowiak. They aimed to select people who would supervise research laboratories and to determine their view of scientific development and the potential to perform organizational functions. Our activities led to two laboratories' organization: Molecular Biology Laboratory under the direction of Svetlana Kaliullaevna Sakhanova and the Morphology Laboratory supervised by Zhanat Komekbai. The laboratories' equipment is not entirely satisfactory, but it allows for basic research in molecular biology and analysis based on immunohistochemical tests (Table 1-2).

Table 1 Specification of the WKMOMU molecular biology laboratory equipment

	Name	Description	Picture	Quantity
1	**System for horizontal gel electrophoresis Mini-Sub® Cell GT Cell** Bio-Rad Laboratories, Inc, USA	The redesigned Mini-Sub cell GT cell offers updated features that make electrophoresis even easier. The Mini-Sub cell GT cell can resolve up to 30 samples; its short, narrow format allows 7 and 10 cm runs with speed, simplicity, and economy.		1
2	**Western blot Electrophoresis Power supply PowerPac™** Bio-Rad Laboratories, Inc, USA.	It is electrophoresis power supply. It offers timer control and constant voltage or constant-current output.		1
3	**Chemidoc MP** Bio-Rad Laboratories, Inc, USA.	System for flexible, high-sensitivity multiplex fluorescent and chemiluminescence western blot detection, imaging gels, analysis and documentation. The ChemiDoc MP Imaging System is a full-feature, best-in-class instrument for imaging and quantifying nucleic acid and protein in gels and western blots. It is capable of imaging fluorescent western blots (RGB, far-red, near-IR), chemiluminescent western blots, all common nucleic acid and protein gel stains, plus stain-free gels. Includes 19" monitor (4:3), keyboard and mouse.		1
4	**Pipette sets Transferpette® S, adjustable, CE-IVD, DE-M** 0,1-2,5 µl, 2-20 µl, 20-200 µl, 100-1000 µl Brand Eppendorf AG, Germany	Efficient: one-hand operation Flexible: ergonomic design for all hand sizes Reliable: volume-change protection prevents accidental adjustments		**3**

5	**Votrex, Bio-Rad Laboratories, Inc, USA.** With FLATHEAD ATTACHMENT FOR VORTEX	The BR-2000 vortexer is a heavy-duty, all-purpose mixer designed for a variety of mixing applications from gentle sample mixing to resuspending cell pellets. Includes a general-use cup attachment that is ideal for small test tubes and microtubes; a flathead dimpled adaptor is available separately for mixing larger volumes or bottles and flasks. 120 V, vortex mixer, 0–3,000 rpm, continuous or touch activation, includes general-purpose cup attachment, CE approved		**1**
6	**Synergy LX Multi-Mode Reader** BioTek Instruments Inc. USA **Micro-Volume Plate** BioTek Instruments Inc. USA	Synergy™ LX Multi-Mode Microplate Reader economically automates many common microplate assays. Its large touchscreen user interface and onboard software simplify programming and operation for microplate and micro-volume assays. The high quality optic design ensures excellent data in absorbance, fluorescence and luminescence detection modes, enabling many common assays including nucleic acid and protein quantification, ELISA, BCA, Bradford and cell viability. Immediate data display, plus output to a USB flash drive, printer or Gen5™ Software makes the Synergy LX a versatile assay workstation. The upgradable design allows your lab to buy what is needed today and add other detection modes in the future. Micro-volume quantification is fast and easy with the Take3™ Micro-Volume Plate, used in your BioTek microplate reader. Measure multiple 2 µL samples at a time, without diluting and without needing specialized equipment. Pre-programmed nucleic acid and protein protocols in Gen5 make quantification fast and easy.	 	**1**

7	**Mini Rocker, 230V Bio-Rad Laboratories, Inc, USA**	30 V (EU/UK), three-dimensional rocking platform for staining and destaining gels, and blotting applications for up to four 8 x 10 cm or two 10 x 20 cm blotting boxes. CE approved		**1**
8	**TS-100 Thermo-Shaker for microtubes and PCR plates Biosan, Lithuania**	Thermo–Shaker TS-100 provides intensive mixing and temperature control of samples in microtest tubes or PCR plate. Functions of heating (up to +100°C) and mixing can be performed both simultaneously and independently, i.e. the unit implements three devices in one: 1. Shaker; 2. Dry–block Thermostat; 3. Thermo–Shaker. TS-100 is used for DNA analysis sample preparation, for extraction of proteins, polysaccharides, lipids and other cellular components. Features of TS-100 meet the increased requirements of the user, including: Quickly reaches the set mixing speed and maintains same amplitude of rotation around the block; Stable maintenance of the temperature of a wide range over the entire surface of the block; LCD display shows the set and actual temperature, speed and time; Quiet engine operation, compact size, long service life. Heating source is a printed heating board (12 V). Mixing is provided by movement of orbital type. The instrument is applicable in: Genetic analysis — in extraction of DNA, RNA and further sample preparation; Biochemical study of enzymatic reactions and processes; Extraction of metabolites from cellular material.		**1**

		 **SC-24 24 × 2 ml microtubes**  **SC-96A 96-well unskirted or semi-skirted microplate (0.2 ml) for PCR**		
9	**-86°C Ultra Low Temperature Cost-effectiveFreezer DW-HL218 China**	Meling -86°C ultra low temperature freezer DW-HL218 is a laboratory freezer and medical freezer. This ultra deep freezer is equipped with high-precision temperature control, ensuring the temperature uniformity in the cabinet with a range of -40°C to -86°C. The targeted refrigeration of the deep freezer enables fast refrigeration. It is designed in human-oriented with energy saving and environmentally friendly. It can safely store laboratory research materials, pharmaceutical raw materials, and more. This medical / laboratory deep freezer is suitable for using in blood banks, health and disease prevention systems, hospitals, colleges & universities, research institutions, the electronic industry, laboratories in colleges & universities, biological engineering, military enterprise, deep-sea fishing companies, etc.		**1**

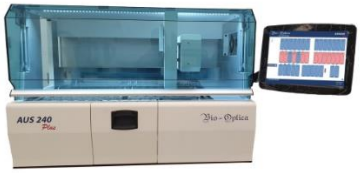
10	**Western blot Electrophoresis Trans-Blot® Turbo™ Bio-Rad Laboratories, Inc, USA.**	The Trans-Blot Turbo Transfer System is a high-performance western blotting transfer system designed to provide rapid transfers with high efficiency. The system enables blot transfer of protein in as little as 3 minutes without sacrificing performance when compared with traditional tank protein blotting.		**1**
11	**Western blot Electrophoresis Chamber with accessories Mini-PROTEAN Bio-Rad Laboratories, Inc, USA.**	The Mini-PROTEAN® Tetra handcast systems are based on the 4-gel Mini-PROTEAN Tetra cell or the highthroughput Mini-PROTEAN® 3 Dodeca™ cell (for running up to 12 gels). The accessories for hand casting provide options for casting mini gels in a variety of thicknesses and comb configurations, and even offer handy gel stands for help in casting gels.		**1**
12	**Sterilizer steam VKA-75-R PZ automatic** VKA-75-R-PZ, Russia	The sterilizer - VKA-75-RPZ - is intended for use in the drugstores, laboratories, for sterilization of medicinal solutions which are hermetically corked in glass tanks up to 1000 ml. Main properties: - microprocessor control provides continuous and most exact control of parameters and functions of the autoclave - the preliminary vacuum provides effective removal of air from the camera, and, therefore, both optimum saturation the ferry and its penetration in products of irregular shape and texture - - a possibility of change of parameters of the mode of sterilization (temperature, time) - full automation of process of sterilization - a possibility of the choice of two modes of sterilization - 121 ° - C and 134 ° - With: - a possibility of programming of loop variables of sterilization -		**1**

		- highly effective, thermodynamic system of drying - - the central lock of a cover of a vessel - - all basic elements of a sterilizer are made of corrosion and resistant steel, the internal surface of the camera is processed by an electrochemical polishing method that increases its corrosion resistance at influence of the aggressive chloro-containing substances -		

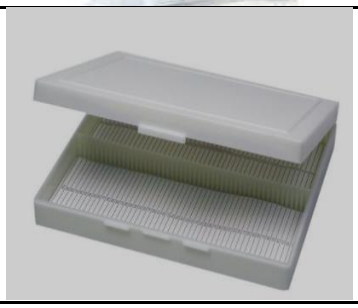
Table 2 Specification of the WKMOMU Immunohistochemistry Laboratory equipment and reagents

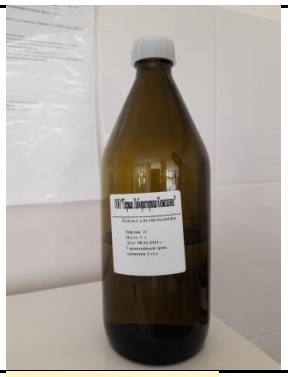
	Name	Description	Picture	Quantity
1	**Embedding System CD 2000** BIO-OPTICA Milano Italy	Modular instrument used to effect the paraffin inclusion of cytological and histological samples. Composed of three separate modules called Paraffin Dispenser, Heating module and cooling module which can be positioned in a different way depending on the operator's requirements.		1
1a	**Paraffin dispenser DP 500**, BIO-OPTICA Milano Italy	The device is designed for filling and forming paraffin blocks. Dispensary dimensions (L × W × H), mm: 360x550x290 Paraffin furnace dimensions (L × W × H) mm: 300x150x100, volume about 4 l Sizes of a working surface (L × W), mm: 360x300 Weight, kg: 21 Temperature control: Using an electronic thermostat with a microprocessor (in the range from + 20ºC to + 70ºC with an accuracy of ± 2ºC)		1

1b	**UT 200 heating module** BIO-OPTICA Milano Italy	A single device with a removable top camera that can be used for basket cassette holders coming directly from the processor. Dimensions (LxWxH): 360x550x290mm Dimensions of the upper chamber (WxDxH): 315x210x104mm Dimensions of the removable upper chamber for paraffin (LxWxH): 310x195x100mm Capacity: 5.5 liters. Dimensions of the lower chamber (WxDxH) 265x205x40mm Capacity: 3 liters Weight: 17 kg Power: 330W Fuses: 2N. 3.15 Ampere-5x20mmT3.15AN250V Operating temperature: adjustable from + 20˚C to + 70˚C, error ± 2˚		1
1c	**Cooling module PF 200**, BIO-OPTICA Milano Italy	The cooling module is used to obtain rapid cooling of histological samples included in paraffin. Dimensions (LxWxH): 500x550x290mm Dimensions of the refrigerator (WxDxH): 405x275x48mm Weight: 30kg Power: 600W Operating temperature: programmable up to max -20˚C under the control of internal control of thermostatic temperature Accuracy 0.5˚C		1
2	**Accu-Cut® SRM™ 200 Rotary Microtome** Sakura	The Accu-Cut® SRM™ 200 Rotary Microtome is a reliable rotary microtome developed for all applications of paraffin and hard specimens in clinical, research and industrial laboratories. This instrument displays extraordinary ergonomic characteristics for comfortable operation while maintaining reproducible precision during sectioning. The Accu-Cut SRM 200 Rotary Microtome has various settings for trimming. The specimen retraction function allows section ribbons to be formed immediately and more easily. Sakura Finetek offers, together with the Accu-Edge® Disposable Microtome Blades, a full range of cutting edge solutions for microtomy purposes. The Accu-Cut SRM 200 Rotary Microtome is supplied with a complete package of accessories, so it can be used immediately after installation.		2

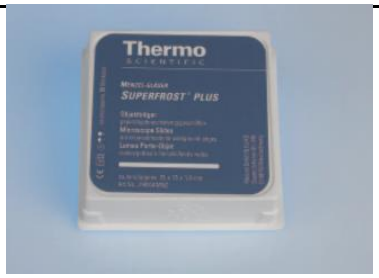
3	**Tissue sample slide dryer PC800** BIO-OPTICA Milano Italy	The PC800 hot plate can dry 30 slides simultaneously. It is equipped with an anodized aluminum work surface and digital electronic thermostat. The temperature is adjustable up to 90°C.		2
4	**Histopathology water bath WB100** BIO-OPTICA Milano Italy	The WB100 round water bath is small, simple and reliable. It is equipped with an analog thermostat, heating indicator light and wide heated surface for 24 slides. Dimensions mm 345x100 (ø x h) and dimensions of internal basin mm 225x50 (ø x h)		2
5	**Automatic Stainer - AUS240 Plus** BIO-OPTICA Milano Italy	Bio-Optica is glad to introduce the updated version of the automatic stainer: AUS240 Plus. These are the main upgrades developed by our R&D team: • The instrument has a new user friendly and intuitive interface; • The user can now stain without sending the basket to the coverslipper; • Possibility to stain macro slides; • RMS System: The user can change reagents while the stainer is working; • It is now possible to set a Priority Protocol. This protocol will have the priority over the other protocols; • Continuous Status Monitoring: The user can check the status of reagents and protocols in every moment from the display. It is possible to set the number of baskets that every tank can receive before the reagent needs to be changed. When the reagent in a tank is		1

		exaust, the user will be informed by the display, where the tank will appear in red. Once the tank will be filled with new reagent, it will appear on the display in blue; • Dripping function to reduce the reagents cross contamination and to keep the instrument clean;		
6	**Microtome blades Surgipath® DB80 LS** Leica	Disposable Microtome blades with chrome coating and honed edge along the entire blade length allows particularity thin and high-quality cuts. Extra-sharp, durable blades ensure consistently precise sectioning from the 1st to the 25th time. Cutting angle 35°		3
7	**Dry-air thermostat electric TC-1/80 SPU** BioMed	This unit is required for the guarantee of reception and further support within the working chamber of constant temperature indicator. This condition becomes necessary to carry out the necessary activities - serological and bacteriological tests. Required implementation of the experiments carried out various social institutions that control the development of high-quality health care - hospitals, public health, clinical diagnostic and bacteriological services. The maximum volume of the working chamber - 80l, chamber material - mirror stainless steel. The thermostat can provide: ventilation and lighting respective working chamber; timely alarm operation; alternately measuring the temperature in the chamber; showing current and target temperature, which are encoded in the figures; automatic control of the necessary regulatory and support required set temperature.		2

8	**MICROWAVE OVEN RM-2002D** REDMOND	For Heat-induced Epitope Retrieval		1
9	**PrimoStar medical laboratory microscope,** CarlZeissMicroscopy GmbH, Germany	The PrimoStar microscope is a universal light microscope designed primarily for examining sections of cells and tissues. Tripod with binocular tube LxWxH 190x410x395mm Tripod with phototube DxWxH190x425x395mm Tripod with a 30˚ / 20 binocular tube with an integrated “HD IP” camera for PrimoStar with the tube / phototube rotated 180˚ LxWxH 190x375x395mm Tripod for reflected light illuminator for fluorescence LxWxH 190x410x449mm Permissible temperature +10 to + 40˚C Pollution degree 2		12
10	**Medical laboratory microscope AxioLab A1** CarlZeissMicroscopy GmbH, Germany	The AxioLab A1 microscope is a universal light microscope designed primarily for examining sections of cells and tissues.		1
11	**Microscope slide storage box, 100 slides**	This microscope slide box provides storage for up to 100 slides. Made from durable polypropylene plastic, with two hinges and a snap catch. There is a numbered index card in the bottom of each of the two rows.		20

12	**Xylene**	Histologists use Xylene as a short-term hydrophobic clearing agent of tissue samples.		10
13	**Complete Manual Staining Assemblies**	Made from stainless steel and holds up to 19 slides.		20
14	**Microscope slide Cover Glass**	**These premium quality globe glass slide covers come in a variety of sizes and thicknesses. They come packaged in a vacuum sealed aluminum foil pouch that contains a desiccant to the glass covers from sticking together. They are then packaged in a resealable plastic case to protect the covers from breaking.**		10
15	**BIO MOUNT HM**, MEDIO DE MONTAJE 500 ML	*Bio Mount HM* makes the histological preparation stable in the presence of light, high temperatures, low temperatures, humidity and UV rays, keeping the prepared unaltered over time. It is perfectly compatible with processes of clarification conducted in xylene, toluene and d-limonene.		

16	**Hematoxylin Solution, Mayer's**	Used as a counterstain for procedures such as immunohistochemistry or laser microdissection. General purpose nuclear stain, progressive type. Used with hematoxylin and eosin staining.		5
17	**Eosin Y solution, aqueous**	General purpose cytoplasmic counterstain. Used with hematoxylin and eosin staining.		5
18	**Embedding Cassettes**	Disposable plastic tissue cassettes are suitable for holding and identifying tissue samples in processing, embedding, and sectioning procedures. The cassettes fit securely in microtome chuck adapters. They are molded from a high density polymer that is totally resistant to the chemical action of histological solvents. These cassettes are designed to accept standard metal lids and will keep specimens in complete safety during processing. The slanted writing surface accepts markings easily, permitting sample identification throughout all stages of embedding and long afterwards when in archives. Each case contains 3 dispenser boxes of 500 cassettes.		5
19	**Buffered Formalin**	Prepared 10% Neutral Phosphate Buffered Formalin is available for the histotechnologist who prefers the convenience of having a ready-to-use fixative at hand		20

20	Pipets 0.1-2 µL 2-20 µL 20-200 µL 100-1000	Pipette-TopPette Dragon lab Single-channel Adjustable Volume Mechanical Pipettor		4
21	Tweezers	Tweezers are made for the use in the laboratory. They are made of anti-magnetic stainless steel, or made of magnetic stainless steel. The surface is highly polished.		10
22	**20 Slide Folder for Specimen Transport**	The 20 Slide Folder is a robust chipboard folder made using a double wall construction. The front slide protection flaps are made to fold back without risk of damage to the hinge. Each slide is identified with a number and by an index printed on the front. The slides are easily removed simply by touching either end of the slide. To avoid contamination of the folder by wet sides, the two lid-flaps are indented on the inside.		20
23	**Thermo Scientific™ SuperFrost Plus™ Adhesion slides**	Minimizes tissue loss during staining resulting in quick turn-around times and reduced risk associated with tissue loss and repeat testing. Thermo Scientific™ SuperFrost Plus Slides secure frozen and formalin-fixed, paraffin embedded tissue sections as well as cytology preparations.		15

24	**Pharmaceutical refrigerator HF-400-2** Pozis, Russia	Microprocessor temperature controller with the supersensitive temperature sensor; mechanical air circulation system; metal door with a lock; automatic temperature maintenance in the compartment; alarm signal when temperature deviates from the preset one; temperature display on the control panel; fan shut-off when the door is open, plastic containers for pharmaceuticals - 2 pcs.		

Molecular biology methods have tremendous value not only in the investigation of basic scientific questions, but also in application to a wide variety of problems affecting the overall human condition:

- Disease prevention and treatment,
- Generation of new protein products,
- Manipulation of animals for desired phenotypic traits.

Because of the wide applicability of these methods, they are rapidly becoming pervasive. We trust that the equipment purchased during the project duration will be used to implement all the aforementioned purposes. The equipment currently located at WKMOMU can be used in many research fields in biology and molecular genetics. All techniques based on the application of PCR (polymerase-chain reaction) can be mentioned here, from genetic to virologic diagnostics (for example, determination of HPV). It is also worth emphasizing that the laboratory equipment allows for a wide range of tests in which whole blood is the research material (protein detection systems, such as gel documentation system and equipment for protein electrophoresis).

Applications of immunohistochemistry

Since immunohistochemistry involves specific antigen–antibody reactions, it has apparent advantage over traditionally used special enzyme staining techniques that identify only a limited

number of proteins, enzymes, and tissue structures. Therefore, it has become a crucial technique and is widely used in many medical research laboratories as well as clinical diagnostics:

- Identification of prognostic markers in cancer
- Diagnosis of tumors of uncertain origin
- Prediction of response to therapy
- Confirmation of infectious agent in tissues
- Determination of the function of specific gene products subclassification of neurodegenerative disorders and the development of consensus criteria for their diagnosis
- Research application.

Flow cytometry

One of the laboratory equipment purchased at WKMOMU without the recommendation of PUMS experts is a flow cytometer. The Navios EX flow cytometer is a leading equipment in the world cytometry applications with workflows for high demands. It offers up to 12 parameters for high complexity fluorescence signals; high sensitivity and resolution; as well as high quality, reproducible results. It can be equipped up to three lasers, 488 nm blue laser, 638 nm red laser and 405 nm violet laser, which enables versatile use of different fluorescence settings. Solid state laser independently focused diode lasers with integrated flow cell minimizes light loss, and compensation problems. Narrow angle scatter can detect larger particles, while scatter signal amplification can be used for submicron particle detection. It stands for a highly advanced tool both for sophisticated diagnostic phenotypic analysis and large variety of research application. Unfortunately, while the equipment for flow cytometry is very modern and useful, the accessibility to flow cytometry reagents is very poor and until now only very basic antibodies were used in very limited range. Due to the vast possibilities of flow cytometry in scientific research, we decided to expand the spectrum of training courses associated with this methodology. A series of meetings and consultations were carried out, covering the cytometer operation's basics and its possible use. In the course of activities aimed at organizing the functioning of laboratories, several problematic issues were identified that could not be ignored because they may cause long-term complications in further developing scientific research. The first of the problems is a range of difficulties in the efficient implementation of the procurement process for laboratory equipment and reagents. As a contractor of the project, we took all possible steps to identify the source of this problem: many discussions with WKMOMU employees were carried out; the specifications of the recommended equipment were properly prepared; problems regarding the tender process for equipment dedicated to WKMOMU laboratories were presented to the Head of PMU, National Project Coordinator, MPA Bolat Tokezhanov. Unfortunately, for many years (before the implementation of the project and its first stages), there was no progress in the issue mentioned above, both in terms of the equipment and reagents. The waiting time for the freezer purchase exceeded 5 years, while the regular waiting time for the reagents purchase was one year or longer. However, it should be underlined that after meetings and discussions with the new Executive Director there was a noticeable improvement in this respect. The last year was not satisfactory again – but it could be due to the pandemic restrictions. The WKMOMU rectors' authorities should pay more attention to these important issues.

The second risk factor is the lack of knowledge of the English language among WKMOMU employees. This significantly hindered the appointment of training participants and identified potential leaders of the laboratories we create. However, the issues mentioned above relate to the project implementation period and do not have to be understood as crucial for the future of WKMOMU. However, as a long-term partner of WKMOMU, we feel responsible for the long-term development of WKMOMU's research potential. We believe that the lack of communication in English will result in in the lack of opportunities for obtaining funds, publishing research results, establishing cooperation with leading research centres.

Another factor that significantly hinders the development of the research area of WKMOMU is the lack of communication between university departments. The units subject to WKMOMU are clinical hospitals where analyses based on molecular biology or immunohistochemistry techniques are routinely performed. It raises a question, therefore, why the potential of clinical laboratory employees is not used in the context of training and workshops conducted at WKMOMU. As an executive entity of the project, we have made every effort to ensure that the laboratory staff have sufficient knowledge and skills to conduct research experiments independently. It seems, however, that the dialogue between basic and clinical laboratories enabling the exchange of experiences is a necessary factor for the continuous improvement of research skills.

The lack of staff interested in conducting scientific research or participating in training is also a huge problem. An example is the flow cytometry training with one person who had no background in immunology. Another example is the Aklides system, which WKMOMU purchased without guidance from PUMS experts. No one from the science department has sufficient knowledge to properly prepare samples for analysis and correctly interpret the obtained analysis results. PUMS employees have taken steps to undergo training in using and interpreting results obtained at AKLIDES (contact with the representative office in Germany). Unfortunately, shortly after returning to Poland, information was received that the employee of WKMOMU who was responsible for handling AKLIDES resigned from the function.

In conclusion, it should be noted that the research architecture of the laboratories organized at WKMOMU provides a wide range of possibilities for conducting analyses, the application of which is possible both in the field of basic and clinical sciences. One of the conditions for ensuring the facilities' proper and efficient functioning is to ensure the successive supply of reagents necessary for conducting analyses. It is also worth considering to provide laboratory employees with training in leading centers in Western Europe and/or the United States. It is one of the best ways to learn about the wide use of molecular biology and immunohistochemistry techniques, acquire English language skills and experience functioning in a world where science has no limits.

SUBTASK 1C2

„Involvement of teaching staff as research advisors for research activities to be conducted as part of master's and doctoral/PhD programs"

Task Leader:	Prof. Jarosław Walkowiak
Subtask supervisor:	Prof. Jarosław Walkowiak
Key-experts:	Prof. Maciej Krawczyński
	Prof. Krzysztof Książek
	Prof. Aleksandra Lisowska
	Prof. Agnieszka Malińska
	Prof. Marcin Ruciński
	Prof. Andrzej Tykarski
	Prof. Jarosław Walkowiak
	Prof. Katarzyna Wieczorowska-Tobis
	Assoc. Prof. Sławomira Drzymała-Czyż
	Assoc. Prof. Marzena Dworacka
	Assoc. Prof. Witold Szaflarski
	Assoc. Prof. Ewa Wysocka
	Dr. Jan Krzysztof Nowak
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	(1) Report with the description of mentoring and training activities.
	(2) Lectures/workshops/seminars conducted in PUMS and at WKMOMU focused on research methodology and scientific issues related to PhD thesis preparation.

1. THE DESCRIPTION OF MENTORING AND TRAINING ACTIVITIES

a/ PUMS experts as international PhD supervisors

Research ideas that could be settled at WKMOMU were thoroughly considered and determined. Similar attitude was applied to methodological issues and lab research capacities (both in WKMOMU and PUMS). Finally, after several discussions, the shortlist of potential PUMS experts was created. During subsequent individual talks, the aims, resources and limitations, were considered. Introductory fields and ideas were preliminarily determined.
Based on the analysis of the scientific and research potential of PUMS, the target profile of the WKMOMU research laboratory equipment and the scientific activity of the WKMOMU employees, the following leading directions of MSc and PhD projects were determined: oncology, civilization diseases, genetics, endocrinology, pharmacology, nutrition and metabolism.

In November 2019, PUMS key-experts Katarzyna Wieczorowska-Tobis and Jarosław Walkowiak were accepted by WKMOMU regulatory committee ("Problem commission") as international supervisors for first-year PhD students, respectively Kerbez Kimatova and Nazgul Gubai:

1/ "Development of an algorithm of help to old people based on their medical and social needs in Aktobe." (Kerbez Kimatova; public health).
2/ „Features of the clinical course and outcomes of bronchial asthma in children with receptor gene polymorphism and vitamin D deficiency." (Nazgul Gubai; medicine).

At the beginning of 2020, 12 doctoral dissertation proposals for potential WKMOMU PhD candidates were developed. In all proposals, the assumptions of the WKMOMU strategic development plan and the equipment capabilities of the cooperating universities were taken into account.
Proposals for doctoral dissertations included:

1) description of the research problem,
2) description of the research material and characteristics of the methods used,
3) summary of the expected results.

PUMS experts delivered to the contemporary WKMOMU Vice-rector for clinical and scientific affairs subsequent PhD proposals:

1) "Biodemographic analysis of aging and health status in the residents of Aktobe."
2) "Analysis of biological effects of two formulas of resveratrol supplementation in patients with primary hypertension living in the Aktobe region of Kazakhstan."

3) “A comparative analysis of malignant ascites-positive and -negative ovarian cancer patients in the Aktobe region of Kazakhstan.”
4) “The impact of traditional Kazakh diet and Western-style diet on glucose and lipid metabolism – a comparative cross-sectional study.”
5) „Adult type hypolactasia, lactose malabsorption and dairy product consumption – a cross-sectional atherosclerosis Kazakh study.”
6) „The influence of Kazakh fermented national products on early markers of atherosclerosis and intestinal inflammation: a prospective randomized controlled nutritional intervention.”
7) „The Omega-3 to Omega-6 Polyunsaturated Fatty Acid Ratio and Infection Morbidity in Childhood – An Epidemiological Case-Control Study.”
8) „Analysis of processes regulating protein biosynthesis in primary and metastatic tumor of gastric cancer.”
9) “Vascular Endothelial Growth Factor (VEGF) Status in Stage 1 and Stage 2 Stomach Cancer Patients.”
10) “The analysis of hereditary breast and ovarian cancer (HBOC) occurrence in Western Kazakhstan with an attempt to identify the causative *BRCA1* and *BRCA2* mutations.”
11) “Descriptive epidemiology of facial clefts in children born in Western Kazakhstan in 2015-2019.”
12) “Congenital limb defects in children born in Western Kazakhstan in 2015-2019.”

PUMS contributors were ready to discuss projects with potential WKMOMU PhD candidates and/or supervisors. PUMS key-experts – Marzena Dworacka and Jarosław Walkowiak proceeded with all activities related to the selection of PhD candidates to be supervised by PUMS experts (as international supervisors). The WKMOMU representatives presented the list of 25 potential candidates for PhD studies:

1) Taskozhina Gulaim Yesenbayevna,
2) Djubayeva Bagdat Allabergenova,
3) Zhanamanova Raushan Nurbolatovna,
4) Khibina Mirshat Almukhambetovna,
5) Ospanova Gulzhaina Taibekovna,
6) Tulegenova Gulbanu Askerovna,
7) Tlekenova Dilda Dabyskyzy,
8) Rakhatova Gulzhazira Askarkyzy,
9) An Yekaterina Dmitrievna,
10) Sagingaliyev Marat Ruslanovich,
11) Kim Irina Sergeevna,
12) Zholamanova Aigerim Zharasovna,
13) Yerniyazova Zhaugir Kopzharova,

14) Donayeva Ainur Ergalievna,
15) Rysmakhanov Myltykbay Saginayevich,
16) Bisenov Ibrahim Galelovich,
17) Saginaliyev Marat Ruslanovich,
18) Tulegenova Gulzhan Akimgerevna,
19) Ualiyeva Makpal Bolatovna,
20) Baiguliyeva Aigerim Bauyrzhanovna,
21) Akhmetova Ayym Maratovna,
22) Zhalmukhanbetov Kairat Kambarovich,
23) Abitova Anar Zhumabekovna,
24) Taushanova Maya Karibayevna,
25) Artykbayeva Altynay Esetovna.

After e-mail contacts and phone calls, seven candidates expressed their willingness to consider suggested topics out of 12 doctoral dissertation proposals that had been delivered in the past:

1) Tulegenova Gulbanu Askerovna,
2) Taushanova Maya Karibayevna,
3) Donayeva Ainur Ergalievna,
4) Akhmetova Ayym Maratovna,
5) Taskozhina Gulaim Yesenbayevna,
6) Sagingaliyev Marat Ruslanovich,
7) Tulegenova Zhanna Zhusupova,

The candidates also had online meetings with their potential supervisors (Krzysztof Książek and Jarosław Walkowiak assisted in explaining all the details).

PUMS key-experts – Marzena Dworacka and Jarosław Walkowiak proceeded with all the activities related to the potential linkage of PhD candidates with PUMS experts (as international supervisors). Out of 25 potential candidates for PhD studies presented by WKMOMU authorities, four passed the English exam qualifying for the Doctoral School at WKMOMU:

1) Kim Irina Sergeevna,
2) Donayeva Ainur Ergalikyzy,
3) Rysmakhanov Myltykbay Saginayevich,
4) Taushanova Maya Karibayevna.

Subsequently, the exam was passed by one of the WKMOMU employees from the list of those who expressed willingness to consider twelve topics proposed by PUMS experts (Zhusupova Zhanna Tlgenovna) and by one other WKMOMU employee that was not mentioned earlier (Aibolat Doskaliyevich Smagulov). Out of six future WKMOMU PhD students, one upheld the decision to cooperate according to the proposal delivered by Jarosław Walkowiak (Taushanova Maya Karibayevna). Another one (Kim Irina Sergeyevna) agreed with the PUMS key-expert – Anna Mania that she joins the project as an international consultant.

Two PhD students (Donayeva Ainur Ergalikyzy & Zhusupova Zhanna Tlegenovna) resigned from previously accepted proposals and informed us that they already had other topics and other international consultants. The other two WKMOMU future PhD students (Rysmakhanov Myltykbay Saginayevich & Smagulov Aibolat Doskaliyevich) have never contacted PUMS experts. WKMOMU authorities have been informed about all these issues. According to WKMOMU contemporary Vice-rector's request, two potential PUMS key-experts for Donayeva Ainur Ergalikyzy & Zhusupova Zhanna Tlegenovna were found:

1/ Assoc. Prof. Edyta Mądry "Early diagnosis of geno-phenotypic features of bone remodelling at children's fractures" (title as delivered).

2/ Assoc. Prof. Katarzyna Mazur-Melewska "Early predictors of neuro-development disorders at children" (title as delivered).

However, no answer was received. Therefore, this activity was not continued.

As mentioned earlier, PUMS key-expert Anna Mania became the international supervisor of PhD thesis – "Clinical and genetic markers of bone metabolism in children under one year old in the Kazakh population." (Kim Irina Sergeyevna ; medicine). In November 2020, another PUMS key-expert Jarosław Walkowiak signed the consent form to become the international supervisor for Maya Karibayevna Taushanova. However, the WKMOMU supervisor applied to the appropriate WKMOMU regulatory committee ("Problem commission"), without any notice, with a different project ("Improving the organization of medical care for patients with coronary atherosclerosis at the level of primary health care") than agreed preliminarily ("Adult type hypolactasia, lactose malabsorption and dairy product consumption – a cross-sectional atherosclerosis Kazakh study"). The WKMOMU supervisor's project was not accepted. After e-mail exchanges and discussions with the WKMOMU supervisor, PUMS key-expert revised the project to improve its low quality and remain in the field of public health. The revised version ("Atherosclerosis-related cardiovascular diseases as an emerging public health problem in West Kazakhstan – an attempt towards recommendations for improvement of healthcare organization and prophylaxis") was not accepted by the "Problem Commission". However, the positive attitude and commitment to help of its chairperson should be underlined.

As a result of the strategic partnership, WKMOMU employee – Kamila Bokayeva applied to the PUMS PhD School (within the STER Program - Internationalization of doctoral schools of the National Agency for Academic Exchange) and, based on the competition selection procedure, she was admitted as an international PUMS PhD student (from 1st April 2021).

b/ lectures and seminars

Due to COVID-19 pandemic WKMOMU staff members' visits were impossible and were cancelled. According to all amendments, the subtask was reorganized. Lecture and seminar courses were rearranged and held online. Besides, the seminar workshops were included.

In November 2020, the online lecture course "Research advice for research activity to be conducted as a part of the PhD program at the WKMOMU." was organized and supervised by Jarosław Walkowiak. The lectures were prepared and delivered by a team of PUMS experts: Jan Krzysztof Nowak, Krzysztof Książek, Andrzej Tykarski, Maciej Krawczyński, Agnieszka Malińska, Ewa Wysocka. Lectures were grouped into five modules (see point 2 Lectures/workshops/seminars conducted in PUMS focused on research methodology and scientific issues related to PhD thesis preparation).

In November and December 2020, the online lecture course "Research advise for research activity to be conducted as a part of the master's program at the WKMOMU" was organized and supervised by Jarosław Walkowiak. The lectures were prepared and delivered by a team of PUMS experts: Jan Krzysztof Nowak, Krzysztof Książek, Andrzej Tykarski, Maciej Krawczyński, Agnieszka Malińska, Ewa Wysocka. Lectures were grouped into five modules (see point 2 Lectures/workshops/seminars conducted in PUMS focused on research methodology and scientific issues related to PhD thesis preparation).

In the course of project realization, a significant problem concerning PhD and MSc studies at WKMOMU was noted. WKMOMU employees, who should play a scientific supervisor's role, frequently do not present sufficient research experience. It results in their inability to supervise MSc/PhD scientific education and research of their students on the required standard level. In many cases, PhD/MSc theses at WKMOMU did not represent the high-quality level expected in international competition and for publishing manuscripts in IF journals. Therefore, in December 2020, two seminar workshops ("Research advice for research activity was conducted as a part of the PhD program at the WKMOMU" and "Research advise for research activity to be conducted as a part of the master's program at the WKMOMU.") took place. PUMS experts got acquainted with the expanded abstracts (called in Kazakhstan "Annotations") and carried out two workshops with individual meetings (with online project presentations given by all 2nd year PhD and MSc Students) dedicated to particular projects. PUMS key-experts indicated errors or deficits in research protocols and provided students and their supervisors with hints for improvement.

Another significant problem identified by PUMS key-experts during PhD/MSc seminars was the lack of English skills among most PhD/MSc students. They were not able to present their theses in English. Moreover, they did not use scientific world literature. It was astonishing in the case of PhD students who were required to pass an exam confirming their English skills for their admission to WKMOMU for education. These circumstances forced PUMS key-experts to hold

most of the seminars in Russian. Besides, the lack of use of databases in English results in the wrong perception of what is known and what could be new in their research. Fortunately, there were few exceptions among PhD and MSc students who were well prepared for their thesis discussion and had adequate knowledge of their PhD/MSc topic.

In January and February 2021, additional PUMS online lecture course "Research activity – practical hints" conducted as a part of the M.Sci & PhD training at WKMOMU was organized and supervised by Jarosław Walkowiak. The lectures were prepared and delivered by a team of PUMS experts: Ewa Wysocka, Marcin Ruciński and Jarosław Walkowiak. Lectures were grouped into three modules (see point 2 Lectures/workshops/seminars conducted in PUMS focused on research methodology and scientific issues related to PhD thesis preparation).

c/ projects and publications

PUMS key-expert Katarzyna Wieczorowska-Tobis supported the implementation of Kazakh PhD requirements regarding publications for Kerbez Kimatova. After extensive work of PUMS and WKMOMU teams, one common manuscript was published:

1. Sławomir Tobis, Agnieszka Neumann-Podczaska, Lyudmila Yermukhanova, Gulnara Sultanova, Gulnara Kurmanalina, Kerbez Kimatova, Marzena Dworacka, Katarzyna Wieczorowska-Tobis. "Pain in People with Advanced Dementia: The Opinions of Kazakh Medical Students." Journal of Pain Research 2020;13:3307–3314. Doi: 10.2147/JPR.S276479 (abstract 1).

WKMOMU PhD students were invloved in the activities related to ongoing projects that were carried out by PUMS experts:

1. „The risk of atherosclerosis in cystic fibrosis patients and its association with exogenous and endogenous factors that influence the course of the disease" (2011/03/B/NZ5/0571; granted by the National Science Center, Poland),

   A/ WKMOMU M.Sci. student – Victoria Kononets,

   B/ PUMS experts – Aleksandra Lisowska, Jarosław Walkowiak, Jan Krzysztof Nowak.
2. „Endo- and exogenous determinants of cholesterol levels in patients with cystic fibrosis – the significance of cholestasis and plant phytosterol intake" (2018/02/X/NZ5/02592; granted by the National Science Center, Poland)

   A/ WKMOMU M.Sci. student – Victoria Kononets,

   B/ PUMS experts – Sławomira Drzymała-Czyż, Aleksandra Lisowska, Jarosław Walkowiak.

WKMOMU employees were also team members in a new project:

1. "Molecular determinants in gastrointestinal diseases" (502-20-15200100, internal PUMS project, abstract 1)

   A/ WKMOMU M.Sci and PhD students, and employees – Victoria Kononets, Nazgul Gubaj, Saule Bermagambetova, Arystan Dossimov, Zhumabek Dossimov,

   B/ PUMS experts – Jan Krzysztof Nowak, Jarosław Walkowiak.

As a consequence of these actions subsequent manuscripts were published (1) or submitted to peer-review journals (2-4):

1/ Sławomira Drzymała-Czyż, Patrycja Krzyżanowska-Jankowska, Krzysztof Dziedzic, Aleksandra Lisowska, Szymon Kurek, Joanna Goździk-Spychalska, Victoria Kononets, Dagmara Woźniak, Edyta Mądry, Jarosław Walkowiak. „Severe Genotype, Pancreatic Insufficiency and Low Dose of Pancreatic Enzymes Associate with Abnormal Serum Sterol Profile in Cystic Fibrosis." Biomolecules 2021,11,313. Doi: 10.3390/biom11020313 (project 2018/02/X/NZ5/02592; abstract 2).

2/ Jan Krzysztof Nowak, Andrzej Wykrętowicz, Edyta Mądry, Tomasz Krauze, Sławomira Drzymała-Czyż, Patrycja Krzyżanowska, Paulina Sobkowiak, Agata Schneider, Joanna Goździk-Spychalska, Szymon Kurek, Victoria Kononets, Nataliya Kashirskaya, Aleksandra Lisowska, Jarosław Walkowiak. "Preclinical atherosclerosis in cystic fibrosis: two distinct presentations are related to pancreatic status" J. Cyst. Fibr. – submitted. (project 2011/03/B/NZ5/0571; abstract 3).

3/ Jan Krzysztof Nowak, Emilia Dybska, Marzena Dworacka, Natallia Tsikhan, Victoria Kononets, Saule Bermagambetova, Jarosław Walkowiak. "Lactase persistence genotypes associate with its ileal expression." Nutrients – submitted. (project 502-20-15200100; abstract 4).

4/ Jan Krzysztof Nowak, Marzena Dworacka, Nazgul Gubaj, Arystan Dossimov, Zhumabek Dossimov, Jarosław Walkowiak. „Expression profiling of ileal mucosa in asthma reveals upregulation of innate immunity and genes characteristic of Paneth and goblet cells." Allergy, Asthma & Clinical Immunology – submitted. (project 502-20-152500100; abstract 5).

Please find below the abstracts of published papers (abstracts 1-2) and submitted manuscripts (abstracts 3-5), full versions of which are available on demand at PUMS.

Abstract 1

Authors: Sławomir Tobis, Agnieszka Neumann-Podczaska, Lyudmila Yermukhanova, Gulnara Sultanova, Gulnara Kurmanalina, Kerbez Kimatova, Marzena Dworacka, Katarzyna Wieczorowska-Tobis.

Title: Pain in People with Advanced Dementia: The Opinions of Kazakh Medical Students.

Purpose: The medical students' attitude toward pain in people with advanced dementia, while constituting an important factor in care, has rarely been assessed to date. The aim of our study was thus to perform such assessment in medical students in Kazakhstan, to enable an improvement of the existing curriculum (like we previously did in Poland).

Materials and Methods: We analyzed the knowledge about pain using a short anonymous questionnaire, which was completed by 112 students of the Medical University of Aktobe, Kazakhstan.

Results: On average, students listed symptoms of 1.4 ± 1.2 (out of 6 analyzed) pain areas (median 2.0). The symptoms related to changes in mental status were suggested the most often (57 students: 50.9%). The students who indicated these symptoms also listed a higher number of symptoms from the remaining domains (1,1 ± 1.0 [median 1.0] vs 0.6 ± 0.8 [median 0.0]; $p<0.01$). Observational methods in the assessment of the severity of pain in people with dementia were indicated by 44 students (39.3%), but only one participant (0.9%) was able to name an observational scale for pain assessment. Correct answers regarding pain treatment rules were presented by 18 students (16.0%), and the answers of the next 47 participants (42.0%) were very general but suggested the same treatment with no regard to the cognitive status.

Conclusion: The study revealed gaps in the knowledge of Kazakh medical students regarding pain in advanced stages of dementia. Demographic changes, combined with the coexistence of pain with dementia, indicate that medical students worldwide must have sufficient knowledge and skills to adequately care for the continually growing number of people with these conditions. It is imperative in countries like Kazakhstan, where the dementia burden was unrecognized until now, but it will blow up in the near future.

Abstract 2

Authors: Sławomira Drzymała-Czyż, Patrycja Krzyżanowska-Jankowska, Krzysztof Dziedzic, Aleksandra Lisowska, Szymon Kurek, Joanna Goździk-Spychalska, Victoria Kononets, Dagmara Woźniak, Edyta Mądry, Jarosław Walkowiak.

Title: Severe Genotype, Pancreatic Insufficiency and Low Dose of Pancreatic Enzymes Associate with Abnormal Serum Sterol Profile in Cystic Fibrosis."

Background: Several factors could lead to lipid disturbances observed in cystic fibrosis (CF). This study aimed to assess sterol homeostasis in CF and define potential exogenous and endogenous determinants of lipid dysregulation.

Methods: The study involved 55 CF patients and 45 healthy subjects (HS). Sterol concentrations (μg/dL) were measured by gas chromatography/mass spectrometry. CF was characterised by lung function, pancreatic status, liver disease and diabetes coexistence, *Pseudomonas aeruginosa* colonisation and BMI. *CFTR* genotypes were classified as severe or other.

Results: Campesterol and β-sitosterol concentrations were lower ($p = 0.0028$ and $p < 0.0001$, respectively) and lathosterol levels (reflecting endogenous cholesterol biosynthesis) were higher ($p = 0.0016$) in CF patients than in HS. Campesterol and β-sitosterol concentrations were lower in patients with a severe *CFTR* genotype, pancreatic insufficiency and lower pancreatic enzyme dose (lipase units/gram of fat). In multiple regression analyses, β-sitosterol and campesterol concentrations were predicted by genotype and pancreatic insufficiency, whereas cholesterol and its fractions were predicted by phytosterol concentrations, age, dose of pancreatic enzymes, nutritional status and genotype.

Conclusions: Independent determinants of lipid status suggest that malabsorption and pancreatic enzyme supplementation play a significant role in sterol abnormalities. The measurement of campesterol and β-sitosterol concentrations in CF patients may serve for the assessment of the effectiveness of pancreatic enzyme replacement therapy and/or compliance, but further research is required.

Abstract 3

Authors: Jan Krzysztof Nowak, Andrzej Wykrętowicz, Edyta Mądry, Tomasz Krauze, Sławomira Drzymała-Czyż, Patrycja Krzyżanowska, Paulina Sobkowiak, Agata Schneider, Joanna Goździk-Spychalska, Szymon Kurek, Victoria Kononets, Nataliya Kashirskaya, Aleksandra Lisowska, Jarosław Walkowiak.

Title: "Preclinical atherosclerosis in cystic fibrosis: two distinct presentations are related to pancreatic status"

Background: Patients with cystic fibrosis (CF) are exposed to overlapping cardiovascular risk factors. We hypothesized that CF is characterized by increased arterial stiffness and greater intima-media thickness (IMT).
Methods: This cross-sectional study assessed the digital volume pulse arterial stiffness index (SI_{DVP}) using photopletysmography, measured intima-media complex thickness (IMT) at the common carotid artery, and obtained an extended set of clinical and atherosclerosis-related laboratory parameters.
Results: Fifty-five patients with moderate-to-severe CF (mean age 26.3±8.6 years, BMI 20.3±3.1 kg/m2, FEV1 62±26%) and 51 healthy controls (25.1±4.4 years, BMI 21.7±3.0 kg/m2) entered the study. SI_{DVP} was greater in pancreatic insufficient (PI), but not pancreatic sufficient (PS) CF patients compared with control (7.3±1.8 m/s vs 6.0±1.2 m/s; $p=7.1\times10^{-5}$). IMT was increased in PS (but not PI) participants relative to control (552±69 µm vs 456±95 µm, p=0.0011). SI_{DVP} was also greater in PI than in PS patients (7.3±1.8 m/s vs 6.3±1.7 m/s, p=0.0232) and IMT was higher in PS compared with PI (552±69 µm vs 453±82 µm, p=0.0002). SI_{DVP} independently associated with age, PI, the lack of liver cirrhosis, and with *Pseudomonas aeruginosa* colonization. PS was the only independent correlate of IMT in CF.
Conclusions: Two forms of atherosclerosis are clearly discernible in CF. PI patients are at risk of developing general arterial stiffness. PS relates to carotid IMT thickening, which underscores the need for reconsideration of dietary guidance in CF. IMT requires further study in PS CF.

Abstract 4

Authors: Jan Krzysztof Nowak, Emilia Dybska, Marzena Dworacka, Natallia Tsikhan, Victoria Kononets, Saule Bermagambetova, Jarosław Walkowiak
Title: "Lactase persistence genotypes associate with its ileal expression"
Background: Little is known about the relationship between *LCT* genotypes and intestinal expression of *LCT*. We aimed to investigate ileal expression of *LCT* depending on main genetic polymorphisms, age, sex, smoking status, body mass index (BMI), and the expression of other genes;
Methods: phenotype, array-based genotype and ileal mucosal biopsy expression data of healthy participants were obtained from the CEDAR study;
Results: analyses included 196 healthy Europeans (53.6% women) aged 53.0±13.6 years, with a mean BMI of 25.6±4.2 kg/m^2, of whom 17.4% were smoking. Ileal *LCT* expression did not strongly depend on age, sex, BMI, or smoking. Rs4988235 homozygous minor allele (GG) associated with a lower *LCT* expression (vs AG $p=2.2\times10^{-6}$, vs GG $p=1.1\times10^{-7}$). Homozygous major allele of rs3754689 (GG) was related to higher *LCT* expression (vs AG $p=1.7\times10^{-5}$, vs AA p=0.0074). However, in rs4988235-heterozygous subgroup rs3754689 genotype did not associate with *LCT*

expression (GG vs AG p=0.051). Interestingly, the expression of *CD14*, which is a marker of monocytes and macrophages, strongly negatively associated with *LCT* expression (r=-0.57, $p_{FDR}=1.1\times10^{-14}$) in CEDAR;
Conclusions: apart from rs4988235, rs3754689 is associated with ileal *LCT* expression. Ileal *LCT* expression does not seem related to age, sex, smoking or BMI. The inverse correlation between *LCT* and *CD14* expression in the ileum is striking and requires further investigation.

Abstract 5

Authors: Jan Krzysztof Nowak, Marzena Dworacka, Nazgul Gubaj, Arystan Dossimov, Zhumabek Dossimov, Jarosław Walkowiak
Title: „Expression profiling of ileal mucosa in asthma reveals upregulation of innate immunity and genes characteristic of Paneth and goblet cells"
Background: The expression profiles of the intestinal mucosa have not been investigated in asthma yet. We aimed to explore them in the Correlated Expression and Disease Association Research (CEDAR) cohort.
Methods: Differential expression analysis of ileal, transverse colon and rectum biopsies was supplemented by comparison of transcriptomes from platelets and subsets of leukocytes: CD4+, CD8+, CD14+, CD15+, and CD19+. Patients with asthma (n=15) and controls (n=15) were characterised by similar age (p=0.967) and body mass index (p=0.870). The percentage of women (80%) and smokers (13.3%) in both groups was identical.
Results: Significant differential expression was found in the ileum alone, and not in any other cell/tissue type. More genes were over- (1150) than underexpressed (380). Most overexpressed genes included Fc Fragment Of IgG Binding Protein (*FCGBP*, logFC=3.01, pFDR=0.015), Mucin 2 (*MUC2*, logFC=2.78, pFDR=0.015), and Alpha 1B Defensin (*DEFA1B*, logFC=2.73, pFDR=0.024). Gene ontology implicated the immune system, including interleukins 4 and 13, as well as antimicrobial peptides. There was concordance of gene over- (*STAT1*, *XBP1*) and under-expression (*NELF*, *RARA*) in asthma and CD ileum from another dataset ($p=3.66\times10^{-7}$).
Conclusion: Ileal mucosa in asthma exhibits a specific transcriptomic profile, which includes overexpression of innate immunity genes, mostly characteristic of Paneth and goblet cells, and some other changes that may resemble Crohn's disease.

2. LECTURES/WORKSHOPS/SEMINARS CONDUCTED IN PUMS AND AT WKMOMU FOCUSED ON RESEARCH METHODOLOGY AND SCIENTIFIC ISSUES RELATED TO PHD THESIS PREPARATION.

PUMS online lecture course "Research advice for research activity was conducted as a part of the PhD program at the WKMOMU" (13th – 27th November 2020) – PUMS expert team: Jarosław Walkowiak, Jan Krzysztof Nowak, Krzysztof Książek, Andrzej Tykarski, Maciej Krawczyński, Agnieszka Malińska, Ewa Wysocka.

1/ Module A – The practical research process and early scientific career.

1. Data analysis, result presentation and journal choice.
2. Strengthening early research career.

2/ Module B – Methodology for preparing first research projects and scientific publications.

1. The role of a PhD student as a member of a research group.
2. How to define areas of scientific interest and select research topics?
3. Which scientific ideas are worthy of implementation and why?
4. What improves and what decreases the quality of research projects?
5. How to prepare the correct research methodology?
6. How to employ graphics to improve our research application?
7. Principles of statistical analysis of results.
8. How to select a journal in which our results will be published?
9. A methodology of writing scientific articles.

3/ Module C – Basic principles of cytogenetic and molecular analysis of human genome.

1. Methods of cytogenetic analysis of human genome. Identification of chromosomal aberrations and genomic rearrengements.
2. Methods of molecular analysis of human genome. Identification of known and unknown gene mutations.

4/ Module D – a practical guide to publishing manuscripts.

1. Publish or perish: Where are we heading?
2. How to write your first scientific paper?
3. How to publish your first scientific journal article?
4. A brief guide to writing your first scientific manuscript – part I.
5. A brief guide to writing your first scientific manuscript – part II.
6. How to get your first journal article published – technical tips and tricks.

5/ Module E – The basis of laboratory diagnostics.

1. Laboratory diagnostics as a part of modern scientific medicine.

Seminar workshop "Practical advice for PhD research activity" was conducted as a part of the PhD program at WKMOMU **(4th – 12th December, 2020).**

1. PUMS key-experts' reviews of every PhD thesis

2. Online presentations:
    a. background,
    b. aims,
    c. material and methods,
    d. obtained or anticipated results.
3. Discussions (errors or deficits and hints for improvement):
    a. up-to-dateness and originality of the proposed work,
    b. material (selection methods, sample size, control group),
    c. methodology (actual and proper methods, team experience),
    d. research hypotheses (clear and achievable aims),
    e. scientific novelty and practical significance.
4. Feedback when needed

The subsequent PhD theses were reviewed and discussed:

1. "Morphological features of the Sella turcica and its practical significance" – Merey Aliyeva (Medicine),
2. "Polymorphism of the TLR3 gene in a susceptibility to chronic viral infectious hepatitis in the Kazakh population of the Aktobe region" – Gulzhanat Nurlanova (Medicine),
3. "Optimization of rehabilitation care for stroke patients in primary care" – Akgul Baizullina (Medicine),
4. "Features of the clinical course and outcomes of bronchial asthma in children with receptor gene polymorphism and vitamin D deficiency" – Nazgul Gubai (Medicine),
5. „Development of an algorithm of help to old people based on their medical and social needs in Aktobe" – Kerbez Kimatova (Public health).

Seminar workshop "Practical advice for research activity" to be conducted as a part of the master's program at WKMOMU **(9th – 21th December, 2020)**

1. PUMS key-experts' reviews of every PhD thesis
2. Online presentations:
    a. background,
    b. aims,
    c. material and methods,
    d. obtained or anticipated results.
3. Discussions (errors or deficits and hints for improvement):
    f. up-to-dateness and originality of the proposed work,
    g. material (selection methods, sample size, control group),
    h. methodology (actual and proper methods, team experience),
    i. research hypotheses (clear and achievable aims),

j. scientific novelty and practical significance.

The subsequent M.Sci. theses were reviewed and discussed (titles as delivered by WKMOMU):

1. „Evaluation of the effectiveness of immunization of children under 5 years of age with the Prevenar 13 vaccine in the Aktobe region." – Aigerim Zhaimkul (Public health),
2. „Influence of glass ionomer cements on the clinical and microbiological state of the oral cavity of the first large molars in children in the treatment of dental caries." – Anar Dustanova (Medicine),
3. „Morphological features of diffuse and intestinal forms of stomach cancer." – Gulnaz Yessultanova (Medicine),
4. „Medical literacy of students of higher educational institutions of Aktobe." – Gaini Nurbai (Public health),
5. "The effectiveness of the Triage system in multidisciplinary hospitals in the city of Aktobe." – Nurgul Kulmanova (medicine),
6. „The role of toxic and potentially toxic trace elements in the development of breast neoplasms." – Viktoriya Kononets (Medicine),
7. „Management of nursing control of anticoagulant therapy in patients with atrial fibrillation." – Asemgul Karshyga (Nursing),
8. „Health status and quality of life of elderly people Aktobe." – Akbayan Imanbayeva (Medicine),
9. „Indicators of peripheral blood lymphocyte subpopulation in women with breast cancer (on the example of the Aktobe region)." – Dina Yegizbaeva (Medicine),
10. „Preeclampsy associated with the level of placental growth factor." – Lyazzat Kaldygulova (Medicine),
11. „Assessment of the quality of life of patients in the treatment and rehabilitation of benign laryngeal neoplasms." – Tavurbaeva Akmaral Zholzhigitovna(Medicine).

PUMS online lecture course "Research advise for research activity was conducted as a part of the master's program at the WKMOMU" (13th November – 3rd December, 2020) was organized and supervised by Jarosław Walkowiak. The lectures were prepared and delivered by a team of PUMS experts: Jan Krzysztof Nowak, Krzysztof Książek, Andrzej Tykarski, Maciej Krawczyński, Agnieszka Malińska, Ewa Wysocka.

1/ Module A – The value and modalities of undergraduate research involvement.

1. The exciting world of biomedical research: from ideas to evidence.
2. Developing research competences during undergraduate studies.

2/ Module B – Methodology for conducting first research projects and publishing their results:

1. The role of a student as a member of a research group.
2. How to select the topic of a MSc dissertation?
3. How to improve our substantive knowledge in the area of the MSc dissertation?
4. How to improve our laboratory skills to perform scientific experiments?
5. How to select the correct research methodology?
6. The role of control group.
7. How to employ graphics to improve the quality of the MSc dissertation?
8. Principles of statistical analysis of results obtained.
9. How to select and analyze references?
10. How to select appropriate journal to publish results of experiments?
11. A methodology of writing MSc dissertation.

3/ Module C – Introdcution to human genome and its pathology.

1. Structure of the human genome.
2. Types of mutations and their role in human pathology.

4/ Module D – Let's talk about science.

1. What does science really mean?
2. Everyone will find something for themselves – types of scientific articles.
3. Scientific databases - is it possible to exist without them in the world of science?

5/ Module E – Laboratory testing in atherosclerosis.

1. Routine laboratory testing in atherogenic disturbances.
2. Advanced laboratory testing in atherogenic disturbances.

PUMS online lecture course "Research activity – practical hints" conducted as a part of the M.Sci & PhD training at WKMOMU **(27th January – 12th February, 2020)** was organized and supervised by Jarosław Walkowiak. The lectures were prepared and delivered by a team of PUMS experts: Ewa Wysocka, Marcin Ruciński and Jarosław Walkowiak.

1/ Module A – Laboratory diagnostics – one more step.

1. The role of laboratory diagnostics in scientific research:
   - inclusion and exclusion criteria for the study and characteristics of the study group,
   - prospective study and its substitutes,
   - biochemistry at baseline.

2/ Module B – Data analysis.

1. Practical analysis and visualisation of the results obtained in the course of task 1C1:
   - some numerical form results (ELISA, PCR),
   - results in the form of bands with different intensity (Western Blot).
2. Analysis of gene expression profile using two currently applied methods:
   - 2 ^ -delta delta Ct,
   - Pfaffl method, considering the reaction's efficiency.
3. Standard curve for reading the tested samples' concentration in ELISA assay.
4. Densitometric analysis of the Western blot reaction bands using ImageJ software (with a presentation of a summary statistic with relevant statistical tests calculated in Excel).
5. Visualisation of the results on graphs:
   - generation in Excel and ggplotgui (graphical user interface for the ggplot2 library used to create charts in R programming language),
   - final modification using Adobe Illustrator or Inkscape software.

3/ Module C – Evidence-based medicine – some practical hints.

1. Principles of evidence-based medicine.
2. Study types in biomedicine:
   - basic vs. clinical research,
   - primary vs. secondary research,
   - observational and experimental studies.
3. Practical analysis of published manuscripts and research projects:
   - background,
   - aims,
   - material and methods,
   - results,
   - conclusions.

SUBTASK 1C3
"Support to organization of post-doctoral studies to be hosted by the partnering University"

Task Leader:	Prof. Jarosław Walkowiak
Subtask Leader:	Prof. Jarosław Walkowiak
Key-experts:	Prof. Maciej Krawczyński
	Prof. Krzysztof Książek
	Prof. Agnieszka Malińska
	Prof. Andrzej Tykarski
	Prof. Jarosław Walkowiak
	Assoc. Prof. Marzena Dworacka
	Assoc. Prof. Witold Szaflarski
	Assoc. Prof. Ewa Wysocka
	Dr. Jan Krzysztof Nowak
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	(1) Report with the description of mentoring and training activities.
	(2) Lectures/workshops conducted in PUMS and WKMOMU focused on the organizational and merits-related problems with the development of post-doctoral scientific activity in WKMOMU.
	(3) Road map of new post-doctoral program.

1. THE DESCRIPTION OF MENTORING AND TRAINING ACTIVITIES

The rules of evaluation and recruitment of the candidates were developed mainly based on previous PUMS expert reports' data. The scientific activity of PhD students and graduates measured by the number of published scientific papers and the number of research projects was analyzed. The research topics of potential candidates were also verified. The purpose of the above action was to identify WKMOMU employees with PhD degrees carrying out research in fields identical or related to the leading scientific disciplines of PUMS. As in the case of potential leaders identification, English language skills were defined as a critical criterion.

Due to the low scientific activity and little independence in the field of scientific research of WKMOMU employees and the lack of support in implementing the task by the WKMOMU authorities, the initial requirements for candidates for postdoc activities were verified. It seems that the most crucial criterion is the willingness to conduct scientific research, while an employee has excellent knowledge of English. However, research seems to be not attractive in Kazakhstan what should be thoroughly analyzed by respective authorities. Perhaps, an adequate motivation system should be developed. As a strategic partner, we would like to underline that the lack of English understanding precludes independent scientific work on a high competing international level. However, there is a group of Russian-speaking researchers who try to carry out the research. They certainly should not be excluded. The improvement of English skills via adequate language courses and short- and long-term fellowships could help them to improve the quality of research. However, adequate actions should be started without any unjustified delay.

To sum up, for the future WKMOMU scientific activity, the research areas selected for postdoc employees were the same as for MSc/PhD students: oncology, civilization diseases, genetics, endocrinology, pharmacology, nutrition and metabolism. Our goal has been to create leaders who will specialize in specific research fields, and who will, after the end of the project, be able to develop an independent research team.

In January 2020 (week 13th – 17th), PUMS experts Jarosław Walkowiak and Jan Nowak visited WKMOMU. The primary aim of the visit was the selection of candidates for the post-doctoral research and training visits at PUMS. PUMS experts met the interested candidates discussing the prospects for research activity in Aktobe and investigating the perspectives of durable scientific cooperation with the Polish side in each case. Research experience and output were analyzed to assess the capacity for independent scientific inquiry and research leadership in the future to ensure the long-lasting effects of support from the program. Unfortunately, although different lists of candidates comprised 20 candidates, less than half took part in the meetings. Moreover, English skills we differentiated and predominantly poor.

The task leader held a series of meetings with the senior managers of WKMOMU. The Rector was informed of the current work status and the challenges ahead. Unfortunately, the contemporary Vice-Rector in charge for Strategic Development and International Cooperation knew very little (practically nothing) about the project and did not express interest in it. The Vice-Rector for Educational and Academic Affairs and the Economic Director were involved in the constructive and effective resolution of some immediate and strategic problems to continue the critical work on technical and organizational improvements in WKMOMU. The Vice-rector for clinical and scientific affairs was also contacted.

The experts gave several lectures. They touched upon the main topics of research methodology. Firstly, real-life examples of own projects were used to conduct in-depth discussion and review of challenges inherent to biomedical research and the appropriate solutions. This met with the interest of the audience, who appreciated the relevance of the new knowledge for their own scholarly work. Secondly, an overview of various types of studies was presented, including, among other clinical trials, cross-sectional, cohort, case-control studies, investigations of diagnostic value, case studies, systematic reviews, and meta-analyses. Paradigms of study design, data acquisition and analysis, and critical evidence appraisal were at the center of the presentation. Finally, examples of the latest progress in research possibilities and precision medicine were shown, highlighting the opportunities of self-development in genetic data analytics. Apart from standard methods, e.g., polymorphism assessment, the new -omics approaches were reviewed in the context of the big data revolution. This should be an essential focus since WKMOMU's long-term goal is to equal the ranks with some of the most highly developed institutions in the world.

Additionally, meetings with heads of departments and some of the PhD students were scheduled and took place. This allowed for the establishment of new relations as well as sustaining old ones and drafting future visit plans. Many of the youngest PhD students presented a good command of English and eagerness to further their skills in molecular techniques, mostly based on qPCR and western blotting. Moreover, the academic and technical staff involved in the project was met to fine-tune the details of training in Poland (e.g., flow cytometry).

The experts have explored the options for e-learning and established contact with a renowned international company from Poznan, SuperMemo. The task leader has negotiated with SuperMemo to obtain free access to English online courses in the Russian language for a group of 40 WKMOMU employees (courses worth a few thousand USD), which was prepared for implementation during the next visit.

One of the main problems that arose during the implementation of the project has been to identify candidates for postdoc studies among WKMOMU employees. Therefore, the overarching purpose of the PUMS representatives' visit to WKMOMU was to verify the candidates

proposed by the WKMOMU authorities. Following the meetings, the experts analyzed the received information to select the best candidates for training at PUMS.

Great interest in the possibility of scientific development among the employees of WKMOMU was expected. However, only 7 out of 20 officially suggested candidates declared their interest. Moreover, one of them later withdrew the declaration. Finally, based upon the declared and anticipated availability as well as previous credibility, five candidates were selected to come for ten working-day stays. The best two were expected to be selected for a two-month postdoc fellowship at PUMS (Table 1).

The list of postdoc candidates suggested by the WKMOMU authorities at different stages:

1. Alekenova Nurgul Medicine"/public health
2. Amanzholkyzy Ainur "Medicine"/ Normal Physiology
3. Ayaganov Dinmukhamed “Medicine"/neurology
4. Balmagambetova Aru "Medicine"/ Human Anatomy
5. Balmagambetova Saule "Medicine"/oncology
6. Batyrova Gulnara "Medicine"/ Therapy
7. Bisaliyev Bayirzhan "Medicine"/pediatric surgery
8. Gaidai Andrey "Medicine"/ Obstetrics and Gynecology
9. Hamidullah Alima "Medicine"/ Neurology
10. Koshmaganbetova Gulbakyt "Medicine"/internal medicine
11. Koyshibaev Zhandos "Medicine"/
12. Koyshibayeva Leyla "Medicine"/ Pediatrics
13. Kurmambayev Ergen "Medicine"/endoscopy
14. Musina Aigul "Medicine"/internal medicine
15. Serik Bakhtiyar "Public Health"
16. Tuleuova Raushan "Medicine"/nutritional science
17. Urazayev Olzhas "Medicine"/oncology
18. Zhanabayeva Aigul "Medicine"/ Human Anatomy
19. Zharmakhanova Gulmira "Medicine"/molecular biology
20. Zhekeyeva Botagoz "Medicine"/pediatrics

Table 1 The list of WKMOMU postdocs selected to come to PUMS for a fellowship

No	Full Name	Specialty	Degree/year	Note
1	Gulnara Batyrova	"Medicine"/ Therapy	PhD, 2019	3 months
2	Andrey Gaidai	"Medicine"/ Obstetrics and Gynecology	PhD, 2019	3 months
3	Ainur Amanzholkyzy	6D110100 "Medicine"/ Normal Physiology	PhD, 2018	5 days
4	Bakhtiyar Serik	"Public Health"	PhD, 2016	5 days
5	Botagoz Zhekeyeva	6D110100 "Medicine"/ Pediatrics	PhD, 2017	5 days

PUMS experts analyzed postdoc needs, considered possible cooperating PUMS departments, prepared teaching and training plans, and elaborated proposals of the post-doctoral scientific activity of the WKMOMU candidates. The profile of research interests, low level of experience in research work, and the fact that candidates do not speak satisfactory English became the reason why experts from PUMS had to resume the organization of postdoc studies.

First of all, the emphasis was put on searching for PUMS research units with a similar profile to the research interests of the candidates. The equipment of research laboratories in which WKMOMU candidates are to gain scientific experience has also been verified. The above actions were taken to guarantee the best experimental facilities for postdoc students.

The change of epidemiological situation (COVID-19 pandemic) forced PUMS experts to reanalyze the whole subtask with a suggestion of online contact and work with a reconsideration of proposals of the post-doctoral scientific activity of the WKMOMU scientists. The primary activities were related to the construction of postdocs online training program.

In September and October 2020, the online course "Preparation of the postdocs to play a role of the scientific leaders at the WKMOMU" was organized and supervised by the task leader Jarosław Walkowiak. The lectures and seminars were prepared and delivered by a team of PUMS experts: Jarosław Walkowiak, Jan Krzysztof Nowak, Ewa Wysocka, Maciej Krawczyński, Krzysztof Książek, Agnieszka Malińska. The course comprised five modules.

In January and February 2021, a seminar cycle "From idea to the detailed project" with the participation of six WKMOMU postdocs (Andrey Gaiday, Olzhas Urazayev, Dinmukhamed Ayaganov, Ainur Amanzholkyzy, Gulnara Batyrova, Botagoz Zhekeyeva) took place. PUMS experts (Marzena Dworacka, Jarosław Walkowiak, Andrzej Tykarski) got acquainted with postdocs' projects and gave several scientific consultations.

PUMS key-experts individually analyzed each postdoc candidate's current scientific activity description with her/his nearest future plans. The particular emphasis was put on the current knowledge related to the research topic, the purpose and the methodology of the project. Subsequently, PUMS key-experts carried out online meetings with each postdoc candidate. Every project was discussed in detail. The goal of such activity was the professional help of experienced scientists from PUMS dedicated to WKMOMU postdocs. During each meeting, PUMS key-experts: 1) suggested scientific databases and publications missed by project authors, which provided scientific and methodological background; 2) depicted discrepancies and shortcomings of each project; 3) suggested ways for improvement, including practical advice concerning the study organization (e.g., with medical centers, collaboration with practitioners and clinicians); 4) pointed out all advantages of projects; 5) provided practical information on project realization, including valuable sources of reagents and laboratories for genetic and biochemical analyses, as well as passed practical advice concerning research arrangements (medical centers, collaboration with practitioners and clinicians). Due to WKMOMU language shortcomings, the whole cycle of seminars was held in Russian.

In March 2021, in the course of Task 1C3 and 1C4, PUMS experts reviewed 19 internal WKMOMU projects (15 medicine-based and 4 education-based) – for a more detailed description, see Task 1C4.

2. LECTURES/WORKSHOPS CONDUCTED IN PUMS AND WKMOMU FOCUSED ON THE ORGANIZATIONAL AND MERITS-RELATED PROBLEMS WITH THE DEVELOPMENT OF POST-DOCTORAL SCIENTIFIC ACTIVITY IN THE WKMOMU.

Lectures during PUMS experts visit at WKMOMU (13th – 17th January 2020) – PUMS expert team: Jarosław Walkowiak and Jan Krzysztof Nowak

1/ Module A – "Research methodology."
- real-life examples of own projects,
- review of challenges inherent to biomedical research,
- overview of study types in biomedical research,
- paradigms of study design,
- data acquisition and analysis,
- critical evidence appraisal.

2/ Module B – "Future perspectives."
- progress in research possibilities,
- precision medicine,
- basic genetic data analytics, including polymorphism assessment,
- new -omics approaches in the context of the big data revolution.

PUMS online lecture course "Preparation of the postdocs to play a role of the scientific leaders at the WKMOMU" (9th September – 2rd October, 2020) – PUMS expert team: Jarosław Walkowiak, Jan Krzysztof Nowak, Ewa Wysocka, Maciej Krawczyński, Krzysztof Książek, Agnieszka Malińska

1/ Module A – "The researcher and the data: from question to answer."

The data and their analysis:

1. Open data and MOOC: a trove of opportunities; Publons and providing a valuable review.
2. The R language in biomedical data analysis and visualization.
3. Multifaceted search on molecular targets: literature, molecular, and bioinformatic resources.
4. JASP: introducing a user-friendly and open-source statistical program.
5. Software in the service of research: language, citation, information retrieval and sharing.

The researcher and his career:

1. What can be learned from the mainstream of top biomedical journals?
2. Global research today as defined by the latest challenges and trends in organization
3. A personal experience of academic mobility; scientific CV.
4. Measures of impact and models of academic achievement assessment; careers.
5. Journal club. Making the best of a research conference. Conflict of interest in biomedicine.

From research design to output and its use

1. Translational research: case studies.
2. Identifying relevant research problems at the confluence of own strengths and deficiencies.
3. Clinical research: study types, the EQUATOR network, and case study.
4. Presenting articles, posters, talks and grant proposals; preprinting.
5. Evidence-based medicine in a recall of PICO case studies.

2/ Module B – "Principles of laboratory diagnostics in medical research"

1. The principles of laboratory diagnostics used in scientific work.
2. Attributes of laboratory method: enzyme-linked immunosorbent assay (ELISA) - what is the researcher interested in?
3. Routine and advanced laboratory testing in lipid disturbances.

3/ Module C – "Molecular research & bioethical issues."

Bioethical committee & good research practice

1. Good research practice.

2. Role of the bioethical committee in scientific research and experimental therapies.

Molecular investigations in scientific research

1. Single nucleotide polymorphisms (SNP) and their role in pathology. Linkage analysis. Association analysis. Genome wide association studies (GWAS).
2. Copy number variants (CNV) and their role in pathology. Array CGH and other types of microarrays.
3. Direct DNA sequencing. Next generation sequencing (NGS) - targeted, panel, whole exome sequencing (WES) and whole genome sequencing (WGS).

4/ Module D – "Methodology for preparing, implementing, and reporting research projects."

Lectures:

10. projects devoted to basic science vs. translational projects;
11. how to construct a research group;
12. a selection of research topics;
13. ethical issues in research projects;
14. where to implement a project;
15. phenomenological vs. mechanistic projects;
16. how to define a research hypothesis;
17. how to select and describe a project methodology;
18. specific vs. nonspecific methods;
19. the significance of intervention tests;
20. how to select a proper control group;
21. how to estimate research costs;
22. documentation and analysis of data;
23. high-risk, high-gain projects;
24. how to hide our restrictions and emphasize advantages;

Seminars:

1. a research project evaluation from the reviewer and the panelist perspective;
2. analysis of a specific research project;
3. how to write a good project report;

Exercises:

1. the title and hypothesis of the project matter – attempts to create attractive titles and research hypotheses for scientists from the University of Aktobe;

5/ Module E – "Publication process – from idea till post-review process."

1. How to write an article review – tips and explanation.
2. Use of online databases of scientific journals.
3. How to write a good original publication for a top international journal? – part one
4. How to find a suitable journal to publish your work?

5. How to write a good original publication for a top international journal? – part two.
6. How to write a good original publication for a top international journal? – part three.
7. How to prepare your paper from a technical point of view?
8. How to write a good original publication for a top international journal? – part four (submitting process, correspondence with editor and reviewers).

PUMS seminar cycle "From idea to the detailed project" (26th January – 16th February, 2021) – PUMS expert team: Marzena Dworacka, Jarosław Walkowiak, Andrzej Tykarski (titles as delivered by WKMOMU).

1/" Placental endothelial growth factor receptors (VEGFR-1, VEGFR-2) in preeclampsia in the Kazakh population."

2/" Tumor neoangiogenesis in Kazakh patients as a prognostic factor for gastric cancer."

3/" Clinical and genetic characteristics of Duchenne myodystrophy in the Republic of Kazakhstan."

4/" Early diagnosis of geno-phenotypic features of bone remodeling in fractures in children."

5/" Development of the online Atlas "Elemental status of the population of the Western Region of the Republic of Kazakhstan."

6/" Intracranial hemorrhage in newborns with intrauterine infections."

3. ROAD MAP OF NEW POST-DOCTORAL PROGRAM.

a/ background

The implementation of this task required a detailed analysis of reports covering the entire PUMS/WKMOMU partnership period. Creating a roadmap also needed a thorough interpretation of the observations and experience gained during the project implementation. Moreover, it seems that identifying the strengths and weaknesses that are the basis for the further development of the scientific activity of WKMOMU is necessary to analyze sociological factors.

All the factors mentioned above were taken into account when constructing the attached roadmap pointing to the most important directions of WKMOMU activities constituting the basis for developing scientific and research activities. It is worth noting that among the employees of WKMOMU, there are many people with great scientific potential, scientific motivation and enthusiasm. However, it should also be noted that maintaining their commitment requires more than broadly understood support from the university authorities. The most important issue seems to be enabling the employees of WKMOMU to "enter the world of science". The world should not be understood only in the context of neighboring countries (through cooperation solely in Russian or Turkic languages) but also the leading research centers (at least in Europe), with scientific researchers speaking English. Gaining experience in scientific methodology, work organization, organization and functioning of research laboratories, and finally designing one's professional career should also be considered. Cooperation with countries with post-communistic transformation (like Poland) creates a unique opportunity. Research employees speak English and many of them (particularly from the older generation) have at least passive knowledge of Russian (which could facilitate the contact, at least at preliminary stages – before WKMOMU employees improve their English skills).

b/ general directions for the professional development of post-doctoral scientists at WKMOMU - main points

1. Towards world-class research
   - Development of proficiency in English via online courses, contact with native speakers, and practical use for the purpose of scientific work and international collaboration.
   - Growing and continuous updating of knowledge in their specific fields of interest by lecture of latest publications, guidelines, and participation in international conferences, seminars, workshops.
   - Learning oriented towards advanced methodologies and statistics through courses, lectures, and practical involvement in own research.
   - Providing funding necessary to support ambitious research.
2. Core competencies of future leaders

- Becoming better at management due to a culture of feedback and through adequate balance of individual responsibility and demands from the university/grant agency administration.
- Acquiring key leadership skills by acquiring knowledge and gaining hands-on experience in assigned areas of responsibility.
- Preparing young scientists for independence via the role of principal investigator, co-advisor, and involvement in university affairs.
- Promoting responsibility for research integrity and the highest standard of work through a system of rewards; judicious accountability if necessary.
- Requiring postdocs to teach students and PhDs (teaching being one of the best ways to learn). Ensuring postdocs are positive role-models for the next generation.
- Improvement of communication skills necessary for interpersonal contact, community outreach, research advocacy, inter-institutional networking, and commenting on pertinent news with large impact on the community.
- Fostering professionalism in its four main aspects: immediate workspace, institutional, collegial (within the discipline) and universal (societal); compliance with rules and regulations.
- Adhering to a high standard of ethics to boost research result replicability and enhance the capacity of the new generation of leaders to build public trust in the future.

3. Global and local networking
   - Growing a network of international collaborations based on efficient engagement of postdocs with appropriate partners.
   - Increasing visibility of postdocs within international biomedical societies by providing them with the required tools.
   - Supporting postdocs participation in national and international conferences with the main aim of exposing to world- and national-class research standard, and providing networking research opportunities.
   - Supporting short- and long-term research internships and study visits abroad to strengthen collaborations and enable acquiring new skills.
   - Supporting local and national opportunities for postdoc networking, which are necessary for the exchange of know-how and interdisciplinary synergy.
4. Appraisal of research opportunities, plans, and outcomes
   - Promoting effective grantsmanship owing to a transparent grant application assessment and enabling access to specific courses and materials.
   - Not treating the JCR IF or Scopus indices as the only system of measurement of scientific merit; helping postdocs to strengthen their research, be constructively critical towards own and others work, and engage in research discussions.

- Rewarding reviewing to immerse postdocs in the international publishing ecosystem and expose them to high-quality manuscripts and international reviewer's feedback.
- Growing understanding of unique local opportunities for original research as well as the possibilities of exploring Kazakh genetics, nutrition, and other special inborn and environmental determinants of health and disease in order to enrich global knowledge; understanding of local needs and prospects of introducing new science-based methods and improvements in Kazakhstan to answer them.

5. Career paths and competence transfer
   - Consulting postdocs on career paths both within and outside the academia to enable optimal development of optimal talent and the fullest use of the national human capital.
   - Allowing for cooperation with industry via meetings and mobility to integrate the regional research, development, and production to a mutual benefit; and to transfer skills from the industry to improve the university and postdocs competences. Providing an option to gain short alternate work experiences through industry partners.
6. Work-life balance, welcoming environment
   - Admitting the importance of sustainable lifestyle for postdocs' efficacy at research work: promoting sport, supporting housing and/or adequate solutions and flexibility needed for child care.
   - Creating environment attractive for foreign postdocs to diversify and internationalize the postdoc research workforce.
   - Enforcing universal, world-class anti-mobbing, anti-discrimination policy to respond to the high standard of excellence required of academic institutions in Kazakhstan.

c/ Summary

It should be an exciting time for postdocs at WKMOMU, who will have a range of opportunities to transform their research work and benefit from a new opening required by the higher standards. At the core of the roadmap is the individual postdoc, with unique experience, talents, and prospects who is set to develop the skills and competencies required for the independent accomplishment of world-class scientific projects. The focus on furthering the knowledge of English and the mastery of current scientific methodologies will be of top importance. This crucial task will be supplemented by growing a range of key competencies, emphasizing leadership and management. Two additional factors should enhance the chances of the roadmap's success: a drive towards international networking and critical appraisal of research, fueled by improved understanding of methods and fields by the emerging leaders who hold the promise of a generational change. This needs to consider the vital needs and unique opportunities in Kazakhstan. This ambitious work will not be accomplished without allowing for lifestyles supporting independent creative thinking and complete engagement in scientific work. Likewise,

guidance on the most optimal career paths within and beyond WKMOMU should be provided. Overall, after considering the current state of postdoc research at WKMOMU, this roadmap has been proposed as a means to maximize new chances and make the best use of available time and resources.

d/ Roadmap of new post-doctoral program

The proposal with a potential roadmap of the new post-doctoral program has been presented in Table 2. Key-experts strongly suggest that the WKMOMU authorities should nominate the Council for Postdoctoral Studies comprising exclusively scientifically qualified and active scholars fluent in English, with at least some members having adequate knowledge of WKMOMU and Kazakh background. The Council should undertake further preliminary actions under the auspices of Strategic Partnership University (PUMS).

Table 2 The prosposal for new postdoctoral WKMOMU program

Year	**2021**		**2022**				**2023**
Quarter	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1-Q4**
Expected activities							
A. English skills (online courses)	A1. pre-intermediate		A2. intermediate		A3. advanced		
	A2. intermediate		A3. advanced		A4. individual self-learning		
B. Research knowledge (lecture & seminar courses/workshops)	B1. Evidence-based medicine B2.Methodology	B3.Statistics B4. Publication writing	B5.Fundraising				
		B1. Evidence-based medicine B2.Methodology	B3.Statistics B4. Publication writing	B5.Fundraising			
C. Personal Internationalization	Short- (C1), mid- (C2) and long-term (C3) English language-based fellowships (respectively 1-3, 4-6, and 6-12 months)						
	International specialty-related congress passive (C-P) and active (C-A) participation (World, European, North-American) with English as the only congress language						
	Linking to international research-related center (English language-based contact)						
D. WKMOMU internationalization	Creation of the Council for Postdoctoral Studies and active interaction with postdocs (exclusively English speaking active highly-ranked researches)						
E. Funding resources	Applying for internal WKMOMU project (E1)						
	Applying for: a/ Central Kazakh funding (E2) or b/ Internal/external project together with Strategic Partner (PUMS) or another University/Research Center (E3)						
F. Motivation system	Development and adaptation of an adequate program						

Expected results					
A. English skills	December 2021 – 25% of postdocs completed B2 level (as verified by an exam)	June 2022 – 50% of postdocs completed B2 level (as verified by an exam)	December 2022 – 100% of postdocs completed B2 level (as verified by an exam)		
B. Research knowledge	December 2021 – 50% of postdocs trained (B1-B4)	December 2021 – 100% of postdocs trained (B1-B4)			
	March 2022 – 50% of postdocs trained (B5)	September 2022 – 100% of postdocs trained (B5)			
C. Personal Internationalization	June 2022 – 25% of postdocs taking part in C1 or C2		December 2022 - 50% of postdocs taking part in C1 or C2 (at least 1 in C2)		December 2023 - 100% of postdocs taking part in C1-C3 (respectively at least 10% and 20% in C2 and C3)
	June 2022 – 25% of postdocs taking part in C-P or C-A		December 2022 – 50% of postdocs taking part in C-P or C-A (at least 25% both)		December 2022 – 100% of postdocs taking part in C-P or C-A (at least 75% both)
	December 2021 – 50% linked to Strategic Partner (PUMS) or another department	June 2022 – 100% linked to Strategic Partner (PUMS) or another department			
D. WKMOMU internationalization	July, September & December 2021 – active work of the chairperson, first and final Council for Postdoctoral Studies	December 2020 & December 2023 – Adaptation of the program and activities of Postdoctoral Studies to changig situation			
E. Funding resources	March 2022 – 50% applications for E1-E3			December 2023 – 100% applications for E1-E3 (at least 20% for E2 and 30% for E3)	
F. Motivation system	December 2021 - Introduction of the system	June 2022 – adaptation of the system	December 2023 – continuous analysis and revision of the system		

SUBTASK 1C4
"Development and joint conduct of research projects"

Task Leader:	Prof. Jarosław Walkowiak
Subtask supervisor:	Prof. Jarosław Walkowiak
Key-experts:	Prof. Maciej Krawczyński
	Prof. Krzysztof Książek
	Prof. Aleksandra Lisowska
	Prof. Agnieszka Malińska
	Prof. Andrzej Tykarski
	Prof. Jarosław Walkowiak
	Assoc. Prof. Edyta Mądry
	Assoc. Prof. Witold Szaflarski
	Dr. Małgorzata Jamka
	Dr. Dariusz Walkowiak
Status :	100 % completion
Duration of activity:	June 2019 – March 2021
Output:	Report containing:
	(1) the description of activities undertaken,
	(2) a list of common projects,
	(3) a list of common manuscripts.

1. THE DESCRIPTION OF ACTIVITIES UNDERTAKEN

The purpose of the first analysis was to define areas of scientific research common to WKMOMU and PUMS. The starting point in the implementation of this activity was to define the leaders and candidates for post-doc studies. Based on the carried out analysis, we could identify the field of public health. Unfortunately, identifying common research interests revealed the lack of reliable or even promising scientific disciplines in medicine. For this reason, subsequent work was carried out based on discussion panels with experts visiting WKMOMU as part of strategic partnership activities.

The aim of the discussions was to identify scientific disciplines that fit the current topics of strategic research programs and the interest of WKMOMU researchers. Besides, the equipment of laboratories at WKMOMU and finally also the scientific potential of PUMS were taken into account. Based on the analyses and consultations with experts visiting WKMOMU, the following areas of scientific research were defined: oncology, pharmacology, genetics, civilization diseases, nutrition and metabolism, endocrinology.

In February 2020 (week 17th – 21st), PUMS key-experts Jaroslaw Walkowiak and Maciej Krawczyński visited WKMOMU to discuss the actual possibilities of cooperation based on ongoing research programs. During the meetings with the Vice-rector for clinical and scientific affairs and the Head of Science and Analytical Work Department, the system of extra- and intra-university grants was presented. The ways, sources and amount of money that can be granted for scientific purposes were recognized. The main limitation found during discussions is the fact that the majority of national grants are directed and announced to solve the most important problems of the health care system (which is beneficial for the society but creates some limitations in terms of basic and preclinical sciences, potentially limiting the chances for good IF publications).

The meetings with scientists responsible for grants funded from the central budget and from the university resources allowed to state how the grants are implemented and what their final results and the ways of their settlement are. The most substantial recognized problems are a limited application of modern molecular biology methods and publication of the majority of results in non-IF journals. During meetings with the heads of departments and young researchers interested in cooperation with PUMS, the ideas and possibilities of joint research projects were discussed. Some of them, mainly based on the clinical data collected in Aktobe with the molecular analysis done in Poznan, looked promising, but many were not possible to implement. The current status of technical capabilities, as well as the knowledge and skills of lab staff, was verified during the visitation to the WKMOMU research laboratory. It seems that the cellular biology lab shows the highest potential.

Besides, key-expert Jarosław Walkowiak delivered 40 free (six-month) valid access codes for e-learning from a renowned international company from Poznan, SuperMemo. The

subscriptions were distributed to WKMOMU employees who are involved in the project or are expected to be involved in future activities.

Due to the COVID-19 pandemic, WKMOMU staff members' visits were impossible and were cancelled. According to all amendments, the subtask was reorganized. All activities were arranged as online activities.

WKMOMU employees were involved in the activities related to four projects granted by the National Science Centre (Poland) that had been carried out by PUMS experts. Moreover, they became team members of four ongoing projects (one granted by the National Science Centre and three internal PUMS projects). One of the WKMOMU employees was also involved in a new application of the project that was granted by the National Science Centre (see point 2 The list of common projects). Besides, PhD and MSc students were involved in one of the above-mentioned National Science Center projects, one project that had been carried out by PUMS experts and one new PUMS internal project (see subtask 2).

As a consequence of undertaken activities, seventeen publications with the active participation of WKMOMU employees were finalized. Seven of them were published, one got accepted and nine were submitted to peer-review journals. In addition, PhD and MSc students, as well as WKMOMU employees, were actively involved in works that resulted in the preparation of five manuscripts – two of them published and three submitted (see subtask 2).

In the course of the subtask 1C4 (and partially Task 1C3), PUMS experts reviewed 19 internal WKMOMU projects (15 medicine-based and 4 education-based; titles as delivered by WKMOMU):

1. Medicine:
   - "Assessment of the state of metabolism and bone mineral density in adolescent girls with primary dysmenorrhea in the Kazakh population."
   - "Clinical and functional characteristics of neurological diseases in young children."
   - "Clinical course and outcomes of patients with COVID-associated pneumonia (virus not identified) in the Aktobe dispensary center: a retrospective observational study."
   - "Recurrence of respiratory tuberculosis: monitoring and causes contributing to the development of tuberculosis."
   - "Application of polymeric materials for immobilization. Experimental and clinical rationale."
   - "A prospective study of IgM and IgG in individuals who recover from Covid-19."
   - "Morphological characterization of reparative and precancerous processes in patients with chronic gastritis."
   - "Analysis of Ki67 and Bcl-2 markers expressions in gastric cancer."
   - "Application of fetal mediators of the thymus gland in COVID conditions."

- "Study of biological and genetic properties of regional strains of Klebsiella pneumoniae against the background of global antibiotic resistance and the problems of acquiring hypervirulence factors."
- "The use of platelet-rich autoplasma for the prevention of urological complications in kidney recipients."
- "Study of the relationship of polymorphic variants of genes with the development of alcohol dependence in patients with alcoholism in the Kazakh population."
- "Study of morphological features of the corpus callosum depending on the degree of angiogenesis."
- "Personalized approach to diet therapy in patients with type 2 diabetes mellitus in primary care."
- "Preeclampsia associated with polymorphisms of folate metabolism genes in the Kazakh population."

2. Education
   - "Mastering the basic discipline "General Histology" by 1st-year students of the "General Medicine" department in a distance learning form to consolidate practical skills in a virtual microscope."
   - "Development of professionalism of medical students in the Republic of Kazakhstan."
   - "Study of empathy as an important component of communicative competence in students and nurses using the IRI questionnaire (interpersonal reactive index, Davis test)."
   - "Medical University Branding: Modelling Image-generating Factors."

2. THE LIST OF COMMON PROJECTS

WKMOMU employees were involved in the activities related to projects that were carried out by PUMS experts:

3. "The role of adropin in the regulation of the physiological function of the rat adrenal cortex." (2017/25/B/NZ4/00065; granted by the National Science Centre, Poland)
   A/ WKMOMU employees – Svetlana Sakhanova, Zhanat Komekbai, Karlygash Bekova, Gulnara Sultanova,
   B/ PUMS experts – Agnieszka Malińska, Witold Szaflarski, Marcin Ruciński,
4. „Comparison of the effects of endurance and endurance-strength training programs on the level of endothelial dysfunction in women with abdominal obesity." (2014/13/B/NZ7/02209; granted by the National Science Centre, Poland),
   A/ WKMOMU employees – Elnara Ismagulova, Gulnara Batyrova, Ainur Amanzholkyzy,
   B/ PUMS experts – Jarosław Walkowiak, Małgorzta Jamka

5. „Spontaneous senescence of ovarian cancer cells as an underestimated determinant of tumor progression: research on in vitro and in vivo models." (2017/25/B/NZ3/00122; granted by the National Science Centre, Poland),
    A/ WKMOMU employees – Akylbek Tussupkaliyev, Gulnara Kurmanalina, Andrey N. Gaiday,
    B/ PUMS experts – Krzysztof Książek, Andrzej Tykarski
6. „Endo- and exogenous determinants of cholesterol levels in patients with cystic fibrosis – the significance of cholestasis and plant phytosterol intake." (2018/02/X/NZ5/02592; granted by the National Science Centre, Poland)
    A/ WKMOMU employees – Raisa Aringazina,
    B/ PUMS experts – Aleksandra Lisowska, Jarosław Walkowiak, Sławomira Drzymała-Czyż,

WKMOMU employees were also team members in new projects:

1. „Searching for new causes of Leber congenital amaurosis in Polish patients." (2019/03/X/NZ2/00770; granted by the National Science Centre, Poland).
    A/ WKMOMU employees – Dinara Zholdybayeva, Nurgul Yakhiyayeva,
    B/ PUMS experts – Maciej Robert Krawczynski,
2. "Nutritional interventions in gastrointestinal diseases." (502-0101103115-07588, internal PUMS project).
    A/ WKMOMU employees – Saule Bermagambetova,
    B/ PUMS experts – Sławomira Drzymała-Czyż, Jarosław Walkowiak,
3. "Organizational challenges in rare diseases." (502-20-44055080; internal PUMS project).
    A/ WKMOMU employees – Kamila Bokayeva, Alua Miraleyeva,
    B/ PUMS experts – Dariusz Walkowiak, Jarosław Walkowiak,
4. "Modern western diet – drawbacks and medical challenges." (502-20-21251840; internal PUMS project).
    A/ WKMOMU employees – Nadiar Mussin, Raisa Aringazina,
    B/ PUMS experts – Edyta Mądry, Jarosław Walkowiak

WKMOMU employees were also involved in a new project application that is to be realized in the nearest future:

1. "Exosome-dependent pathomechanism of dormant ovarian cancer cell awakening and growth reinforcement by normal peritoneal cells subjected to carboplatin and paclitaxel." (2020/37/B/NZ5/00100; granted by the National Science Centre, Poland).
    A/ WKMOMU employees – Andrey N. Gaiday,
    B/ PUMS experts – Krzysztof Książek,

3. THE LIST OF COMMON PUBLICATIONS

A/ published

1. Marta Szyszka, Lukasz Paschke, Marianna Tyczewska , Karol Jopek, Piotr Celichowski, Paulina Milecka, Gulnara Sultanova, Ewelina Stelcer, Agnieszka Malinska, Ludwik K. Malendowicz, Marcin Rucinski. Analysis of Transcriptome, Selected Intracellular Signaling Pathways, Proliferation and Apoptosis of LNCaP Cells Exposed to High Leptin Concentrations. Int. J. Mol. Sci. 2019, 20, 5412; doi:10.3390/ijms20215412. (project 2017/25/B/NZ4/00065; abstract 1)
2. Ewelina Stelcer, Paulina Milecka, Hanna Komarowska, Karol Jopek, Marianna Tyczewska, Marta Szyszka, Marta Lesniczak, Wiktoria Suchorska, Karlygash Bekova, Beata Szczepaniak, Marek Ruchala, Marek Karczewski, Tomasz Wierzbicki, Witold Szaflarski, Ludwik K. Malendowicz, Marcin Rucinski. „Adropin Stimulates Proliferation and Inhibits Adrenocortical Steroidogenesis in the Human Adrenal Carcinoma (HAC15) Cell Line". Front. Endocrinol. 11:561370. doi: 10.3389/fendo.2020.561370. (project 2017/25/B/NZ4/00065; abstract 2)
3. Mariusz Szczepanik, Ida Malesza, Joanna Bajerska, Agata Chmurzyńska, Agata Muzsik, Saule Bermagambetova, Edyta Mądry, Jarosław Walkowiak, Aleksandra Lisowska. "Energy-restricted Central-European diet stimulates liver microsomal function in obese postmenopausal women – a randomized nutritional trial with a comparison to energy-restricted Mediterranean diet." Eur. Rev. Med. Pharmacol. Sci. 2020;24:11165-11171. doi: 10.26355/eurrev_202011_23604. (project PUMS 502-0101103115-07588; abstract 3)
4. Paweł Uruski, Justyna Mikula-Pietrasik, Marcin Drzewiecki, Sylwia Budkiewicz, Marcin Gładki, Gulnara Kurmanalina, Andrzej Tykarski, Krzysztof Książek. „Diverse functional responses to high glucose by primary and permanent hybrid endothelial cells in vitro." J. Mol. Cell Cardiol. 2021, 156, 1-6. doi: 10.1016/j.yjmcc.2021.03.004 (project 2017/25/B/NZ3/00122; abstract 4)
5. Paweł Uruski, Justyna Mikuła-Pietrasik, Eryk Naumowicz, Kamila Kaźmierczak, Andrey N. Gaiday, Jan Królak, Błażej Nowakowski, Rafał Moszyński, Andrzej Tykarski, Krzysztof Książek. „Patient-Specific Variables Determine the Extent of Cellular Senescence Biomarkers in Ovarian Tumors In Vivo." *Biomedicines* 2021,*9*(4),330; doi: 10.3390/biomedicines9040330 (project 2017/25/B/NZ3/00122; abstract 5)
6. Małgorzata Jamka, Marta Kokot, Nina Kaczmarek, Saule Bermagambetova, Jan K. Nowak, Jarosław Walkowiak. "Sodium butyrate in inflammatory bowel diseases: a systematic review". Complement Med Res. 2020 Dec 22:1-13. doi: 10.1159/000512952. Online ahead of print. (project PUMS 502-0101103115-07588; abstract 6)

7. Kamila Bokayeva, Alua Miraleyeva, Dariusz Walkowiak. „Rare diseases – a challenge for the medical world." J. Med. Sci. 2021, e503, doi:10.20883/medical.e503. Online ahead of print. (project 502-20-44055080; abstract 7)

B/ accepted

1. Hanna Komarowska, Agnieszka Malińska, Zhanat Komekbai, Barbara Bromińska, Katarzyna Bednarek-Rajewska, Marek Ruchała, Marcin Ruciński. „Immunohistochemical analysis of ghrelin expression in various types of adrenal tumors." Folia Histochem Cytobiol. (project 2017/25/B/NZ4/00065; abstract 8)

C/ submitted

1. Ewelina Stelcer, Hanna Komarowska, Karol Jopek, Agnieszka Żok, Dariusz Iżycki, Agnieszka Malińska, Beata Szczepaniak, Zhanat Komekbai, Marek Karczewski, Tomasz Wierzbicki, Wiktoria Maria Suchorska, Marek Ruchała, Marcin Ruciński. „Mitotane as a potential alternative treatment strategy for melanoma." Cancers (project 2017/25/B/NZ4/00065; abstract 9)
2. Sławomira Drzymała-Czyż, Krzysztof Dziedzic, Artur Szwengiel, Patrycja Krzyżanowska-Jankowska, Jan K. Nowak, Agata Nowicka, Raisa Aringazina, Dagmara Woźniak, Nataliya Kashirskaya, Jarosław Walkowiak. **"**Serum bile acids in cystic fibrosis patients – glucodeoxycholic acid as a potential marker of liver disease." Nutrients (project 2018/02/X/NZ5/02592; abstract 10)
3. Małgorzata Jamka, Edyta Mądry, Patrycja Krzyżanowska-Jankowska, Damian Skrypnik, Monika Szulińska, Radosław Mądry, Aleksandra Lisowska, Gulnara Batyrova, Monika Duś-Żuchowska, Anna Gotz-Więckowska, Paweł Bogdański, Jarosław Walkowiak. "The effect of endurance and endurance-strength training on body composition and cardiometabolic markers in abdominally obese women: a randomised trial." Sci. Rep. (project 2014/13/B/NZ7/02209; abstract 11)
4. Małgorzata Jamka, Edyta Mądry, Paweł Bogdański, Jakub Kryściak, Radosław Mądry, Aleksandra Lisowska, Elnara Ismagulova, Anna Gotz-Więckowska, Izabela Chudzicka-Strugała, Ainur Amanzholkyzy, Jarosław Walkowiak. "The effect of endurance and endurance-strength training on bone mineral density and content and physical capacity in abdominally obese women: a randomised trial." Bone (project 2014/13/B/NZ7/02209; abstract 12)
5. Ida Judyta Malesza, Michał Malesza, Jarosław Walkowiak, Nadiar Mussin, Dariusz Walkowiak, Raisa Aringazina, Joanna Bartkowiak-Wieczorek, Edyta Mądry. "Western-style

high-fat diet, changes of the gut microbiota and inflammation – a chicken and egg situation." (project 502-20-21251840; abstract 13)

6. Anna Skorczyk-Werner, Dorota Raczynska, Anna Wawrocka, Dinara Zholdybayeva, Nurgul Yakhiyayeva, Maciej Robert Krawczynski. "The coincidence of two ultra-rare hereditary eye diseases: gyrate atrophy and Kjer optic atrophy – a surprising diagnosis based on Next-Generation Sequencing." (project 2019/03/X/NZ2/00770; abstract 14)
7. Piotr Celichowski, Karol Jopek Milecka Paulina, Marta Szyszka, Marianna Tyczewska, Svetlana Sakhanova, Witold Szaflarski, Ludwik K Malendowicz, Marcin Ruciński. "The extracellular Nampt (eNampt/Visfatin/PBEF) directly and indirectly stimulates ACTH and CCl2 protein secretion from isolated rat corticotropes." Adv. Clin. Exp. Med. (project 2017/25/B/NZ4/00065; abstract 15)
8. Paweł Uruski, Justyna Mikuła-Pietrasik, Martyna Pakuła, Sylwia Budkiewicz, Marcin Drzewiecki, Andrey N. Gaiday, Małgorzata Wierzowiecka, Eryk Naumowicz, Rafał Moszyński, Andrzej Tykarski, Krzysztof Książek. "Malignant ascites promote adhesion of ovarian cancer cells to peritoneal mesothelium and fibroblasts." Int. J. Mol. Sci. (project 2017/25/B/NZ3/00122; abstract 16)
9. Paweł Uruski, Agnieszka Sepetowska, Corinna Konieczna, Martyna Pakuła, Michał Wyrwa, Akylbek Tussupkaliyev, Andrzej Tykarski, Justyna Mikuła-Pietrasik, Krzysztof Książek. "Primary high-grade serous ovarian cancer cells are sensitive to senescence induced by carboplatin and paclitaxel *in vitro*." Translational Oncology (project 2017/25/B/NZ3/00122; abstract 17)

Please find below the abstracts of published (abstracts 1-7) and accepted (abstract 8) publications as well as submitted manuscripts (abstracts 9-17), full versions of which are available on demand at PUMS.

Abstract 1

Authors: Marta Szyszka, Lukasz Paschke, Marianna Tyczewska , Karol Jopek, Piotr Celichowski, Paulina Milecka, Gulnara Sultanova, Ewelina Stelcer, Agnieszka Malinska, Ludwik K. Malendowicz, Marcin Rucinski.

Title: Analysis of Transcriptome, Selected Intracellular Signaling Pathways, Proliferation and Apoptosis of LNCaP Cells Exposed to High Leptin Concentrations.

Leptin, the first discovered adipokine, has been connected to various physiological and pathophysiological processes, including cancerogenesis. Increasing evidence confirms its influence on prostate cancer cells. However, studies on the ffects of leptin on the proliferation and apoptosis of the androgen-sensitive LNCaP line of prostate cancer cells brought conflicting

results. Therefore, we performed studies on the effects of high LEP concentration (1 x 10^{-6} M) on gene expression profile, change of selected signaling pathways, proliferation and apoptosis of LNCaP cells. RTCA (real-time cell analyzer) revealed inhibitory effect of LEP on cell proliferation, but lower LEP concentrations (10^{-8} and 10^{-10} M) did not affect cell division. Moreover, flow cytometry with a specific antibody for Cleaved PARP-1, an apoptosis marker, confirmed the activation of apoptosis in leptin-exposed LNCaP line of prostate cancer cells. Within 24 h LEP (10□6 M) increases expression of 297 genes and decreases expression of 119 genes. Differentially expressed genes (DEGs) were subjected to functional annotation and clusterization using the DAVID bioinformatics tools. Most ontological groups are associated with proliferation and apoptosis (seven groups), immune response (six) and extracellular matrix (two). These results were confirmed by the Gene Set Enrichment Analysis (GSEA). The leptin's effect on apoptosis stimulation was also confirmed using Pathview library. These results were also confirmed by qPCR method. The results of Western Blot analysis (exposure to LEP 10 min, 1, 2, 4 and 24 h) suggest (after 24 h) decrease of p38 MAPK, p44-42 mitogen-activated protein kinase and Bcl-2 phosphorylated at threonine 56. Moreover, exposure of LNCaP cells to LEP significantly stimulates the secretion of matrix metallopeptidase 7 (MMP7). Obtained results suggest activation of apoptotic processes in LNCaP cells cultured at high LEP concentration. At the same time, this activation is accompanied by inhibition of proliferation of the tested cells.

Abstract 2

Authors: Ewelina Stelcer, Paulina Milecka, Hanna Komarowska, Karol Jopek, Marianna Tyczewska, Marta Szyszka, Marta Lesniczak, Wiktoria Suchorska, Karlygash Bekova, Beata Szczepaniak, Marek Ruchala, Marek Karczewski, Tomasz Wierzbicki, Witold Szaflarski, Ludwik K. Malendowicz, Marcin Rucinski

Title: Adropin Stimulates Proliferation and Inhibits Adrenocortical Steroidogenesis in the Human Adrenal Carcinoma (HAC15) Cell Line.

Adropin is amultifunctional peptide hormone encoded by the *ENHO* (energy homeostasis associated) gene. It plays a role in mechanisms related to increased adiposity, insulin resistance, as well as glucose, and lipid metabolism. The low adropin levels are strongly associated with obesity independent insulin resistance. On the other hand, overexpression or exogenous administration of adropin improves glucose homeostasis. The multidirectional, adropin-related effects associated with the regulation of metabolism in humans also appear to be attributable to the effects of this peptide on the activity of various elements of the endocrine system including adrenal cortex. Therefore, the main purpose of the present study was to investigate the effect of adropin on proliferation and secretory activity in the human HAC15 adrenal carcinoma cell line. In this study, we obtained several highly interesting findings. First, GPR19, the main candidate

sensitizer of adrenocortical cells to adropin, was expressed in HAC15 cells. Moreover, GPR19 expression was relatively stable and not regulated by ACTH, forskolin, or adropin itself. Our findings also suggest that adropin has the capacity to decrease expression levels of steroidogenic genes such as steroidogenic acute regulatory protein (*StAR*) and *CYP11A1*, which then led to a statistically significant inhibition in cortisol and aldosterone biosynthesis and secretion. Based on whole transcriptome study and research involving transforming growth factor (TGF)-β type I receptor kinase inhibitor we demonstrated that attenuation of steroidogenesis caused by adropin is mediated by the TGF-β signaling pathway likely to act through transactivation mechanism. We found that HAC15 cells treated with adropin presented significantly higher proliferation levels than untreated
cells. Using specific intracellular inhibitors, we showed that adropin stimulate proliferation via ERK1/2 and AKT dependent signaling pathways. We have also demonstrated that expression of GPR19 is elevated in adrenocortical carcinoma in relation to normal adrenal glands. High level of GPR19 expression in adrenocortical carcinoma may constitute a negative prognostic factor of disease progression.

Abstract 3

Authors: Mariusz Szczepanik, Ida Malesza, Joanna Bajerska, Agata Chmurzyńska, Agata Muzsik, Saule Bermagambetova, Edyta Mądry, Jarosław Walkowiak, Aleksandra Lisowska.
Title: Energy-restricted Central-European diet stimulates liver microsomal function in obese postmenopausal women – a randomized nutritional trial with a comparison to energy-restricted Mediterranean diet.
Objective: Obesity and metabolic syndrome are risk factors for liver diseases like non-alcoholic fatty liver disease and non-alcoholic steatohepatitis. A healthy food pattern is vital for managing these health problems, therefore, this study investigated how two calorie-restricted diets, the Central European diet (CED) and Mediterranean diet (MED), altered microsomal liver function in obese postmenopausal women with a risk of metabolic syndrome.
Patients and methods: One-hundred-forty-four subjects were randomly assigned to the CED (n=72) or the MED (n=72) groups. A 13C-methacetin breath test was performed, before and after the intervention to assess CPDR (Cumulative Percentage Dose Recovery at 120 minutes of the test), TTP (Time to Peak - maximal momentary recovery of 13C) and Vmax (the maximum momentary 13C recovery).
Results: There was a statistically significant increase in TTP and Vmax in the CED group only (p=0.0159 and p=0.0498, respectively). Changes in CPDR and TTP due to intervention were significantly higher in the CED group than in the MED group (p=0.0440 and p=0.0115, respectively).

Conclusions: This is the first study to document a stimulatory effect of the energy-restricted CED on liver microsomal function as compared to MED. The relatively short dietary intervention led to a significant difference in the CYP1A2 activity between groups.

Abstract 4

Authors: Paweł Uruski, Justyna Mikula-Pietrasik, Marcin Drzewiecki, Sylwia Budkiewicz, Marcin Gładki, Gulnara Kurmanalina, Andrzej Tykarski, Krzysztof Książek
Title: Diverse functional responses to high glucose by primary and permanent hybrid endothelial cells in vitro.
Various types of human endothelial cells, including human umbilical vein endothelial cells (HUVECs) and the established hybrid EAhy926 cells, are used in experimental research. Here, we compared the biological properties of HUVECs and EAhy926 cells under normal (5 mM) and high glucose (30 mM; HG) conditions. The results showed that HG induced cellular senescence and a stronger DNA damage response in HUVECs than in EAhy926 cells. The magnitude of oxidative stress elicited in HUVECs by HG was also greater than that elicited in their established counterparts. Both endothelial cell types promoted the progression of breast (MCF7), ovarian (OVCAR-3), and lung (A549) cancer cells; however, the effects elicited by HG-treated HUVECs on adhesion (MCF7, OVCAR-3), proliferation (OVCAR-3), and migration (OVCAR-3) were more pronounced. Finally, HG stimulated the production of a higher number of proangiogenic agents in HUVECs than in EAhy926 cells. Collectively, our study shows that the functional properties of primary and established endothelial cells exposed to HG differ substantially, which seems to result from the higher sensitivity of the former to this stressor. The interchangeability of both types of endothelial cells in biomedical research should be considered with great care to avoid losing some biological effects due to the choice of cells with higher stress tolerance.

Abstract 5

Authors: Paweł Uruski, Justyna Mikuła-Pietrasik, Eryk Naumowicz, Kamila Kaźmierczak, Andrey N. Gaiday, Jan Królak, Błażej Nowakowski, Rafał Moszyński, Andrzej Tykarski, Krzysztof Książek
Title: Patient-specific variables determine the extent of cellular senescence biomarkers in ovarian tumors *in vivo.*
Abstract:The mechanisms and clinical significance of the cellular senescence of tumor cells are amatter of ongoing debate. Recently, the triggers and molecular events underlying spontaneous,replicative senescence of primary epithelial ovarian cancer cells were characterized. In this study,we reanalyzed tumors obtained from ovarian cancer patients with respect to the expression of thesenescence biomarkers SA-β-Gal andγ-H2A.X and the proliferative antigen Ki67. The results showedthat the tumors displayed strong heterogeneity with respect to the expression

of analyzed markers.The expression of SA-β-Gal andγ-H2A.X in the oldest patients (61–85 y.o.) was significantly higherthan in the younger age groups. Conversely, the area of Ki67-positive cancer cells was greater inyounger individuals. At the same time, there was a positive correlation between SA-β-Gal expressionand calendar age in FIGO III–IV and malignant ascites-positive patients. Theγ-H2A.X positively cor-related with age in the whole group, FIGO III–IV, and ascites-positive patients. Ki67 levels correlatednegatively with the age of patients among those same groups. Collectively, our study indicated thatorganismal aging may determine the development of the senescence phenotype in ovarian tumors,particularly in patients with advanced disease and those accumulating malignant ascite

Abstract 6

Authors: Małgorzata Jamka, Marta Kokot, Nina Kaczmarek, Saule Bermagambetova, Jan K. Nowak, Jarosław Walkowiak

Title: Sodium butyrate in inflammatory bowel diseases: a systematic review.

Introduction: Administration of butyrate enemas might improve the health status of patients with inflammatory bowel disease (IBD). However, the results seem equivocal. Therefore, this systematic review aimed to assess the effect of sodium butyrate enemas on disease activity index (DAI), endoscopic scores, as well as histological and inflammatory parameters in IBD patients.

Methods: The PubMed, Scopus, Web of Science, and Cochrane databases were searched. Randomised controlled trials published in English that assessed the effect of butyrate enemas on DAI, clinical symptoms, inflammatory markers, as well as histological and endoscopic scores in patients with Crohn's disease (CD) and ulcerative colitis (UC) were included in the analysis.

Results: Eight studies involving 227 UC patients were included in this analysis. Only one study reported significant differences in DAI between groups. Besides, butyrate treatment groups did not differ significantly from controls concerning the effect on endoscopic and histological scores. Moreover, butyrate enemas exerted a significant effect on few inflammatory parameters measured in colonic mucosal biopsies.

Conclusion: The current evidence is limited and does not support the application of butyrate enemas in UC. There are no reliable data regarding the efficacy of butyrate enemas in CD.

Abstract 7

Authors: Kamila Bokayeva, Alua Miraleyeva, Dariusz Walkowiak
Title: Rare diseases – a challenge for the medical world.
The diagnosis and treatment of rare diseases have improved signifi cantly in recent years. The length of the diagnosis, which from the point of view of patients and their caregivers was considered the "Achilles' heel" of the healthcare system, has signifi cantly shortened in many cases. Nevertheless, as research shows, the-re is still much to be done regarding the knowledge of rare diseases among healthcare professionals. The processes of diagnosis and treatment, as well as their organisation, should be redefi ned

Abstract 8

Authors: Hanna Komarowska, Agnieszka Malińska, Zhanat Komekbai, Barbara Bromińska, Katarzyna Bednarek-Rajewska, Marek Ruchała, Marcin Ruciński
Title: Immunohistochemical analysis of ghrelin expression in various types of adrenal tumors.
Introduction: Ghrelin increases the proliferation and decreases the apoptosis of adrenocortical cells. In this study, we compared ghrelin expression at the protein level in various adrenal tumors and analyzed whether immunoreactive ghrelin can be considered as a potential marker for different types of adrenal tumors.
Material and methods: The expression analysis was carried out on 200 adrenal specimens. We performed standardized immunohistochemical reactions and obtained semiquantitative measurements.
Results: At the protein level, the expression of ghrelin was significantly reduced in adrenocortical adenocarcinoma (median [interquartile range, IQR] = 78.56 [80.2–65.1]) in relation to the control group (median [IQR] = 110.87 [118.45–99.44]) and both pheochromocytoma (median [IQR] = 133.4 [147.56–109.77]) and cancer-adjacent normal adrenal tissue (median [IQR] = 118.26 [126.35–97.93]). By contrast, a relatively high level of ghrelin expression was found in pheochromocytoma compared to all the analyzed groups, except for the cancer-adjacent normal adrenal tissue.
Conclusions: The altered expression of ghrelin may be associated with adrenal tumorigenesis. The results of our study suggest that ghrelin immunoreactivity may be considered as a sensitive and specific marker for differentiating adrenocortical carcinoma from adrenocortical adenoma and pheochromocytoma.

Abstract 9

Authors: Ewelina Stelcer, Hanna Komarowska, Karol Jopek, Agnieszka Żok, Dariusz Iżycki, Agnieszka Malińska, Beata Szczepaniak, Zhanat Komekbai, Marek Karczewski, Tomasz Wierzbicki, Wiktoria Maria Suchorska, Marek Ruchała, Marcin Ruciński.

Title: Mitotane as a potential alternative treatment strategy for melanoma.

A previous case study described an adrenal incidentaloma initially misdiagnosed as adrenocortical carcinoma (ACC) and treated with mitotane. The final diagnosis was metastatic melanoma of unknown primary origin. However, the patient developed rapid disease progression after mitotane withdrawal, suggesting a protective role for mitotane in a non-adrenal derived tumour. The aim of the present study was to determine the biological response of primary melanoma cells obtained from that patient and in two other established melanoma and ACC cell lines treated with mitotane. Mitotane inhibited proliferation of both ACC and melanoma cells. Flow cytometry analysis and transcriptomic studies indicated that the ACC cell line was highly responsive to mitotane treatment, although the primary melanoma cell line showed only a moderate response. Mitotane modified activity in several key biological processes, including "mitotic nuclear division", "DNA repair", "angiogenesis", and "negative regulation of ERK1 and ERK2 cascade". Mitotane administration led to elevated levels of necrosis, apoptosis, and DNA double-strand breaks. The *in vitro* findings suggest that mitotane is not as effective in melanoma as in adrenal carcinoma cells. To our knowledge, this is the first study to assess the potential of mitotane as a treatment for melanoma.

Abstract 10

Authors: Sławomira Drzymała-Czyż, Krzysztof Dziedzic, Artur Szwengiel, Patrycja Krzyżanowska-Jankowska, Jan K. Nowak, Agata Nowicka, Raisa Aringazina, Dagmara Woźniak, Nataliya Kashirskaya, Jarosław Walkowiak.

Title: Serum bile acids in cystic fibrosis patients – glucodeoxycholic acid as a potential marker of liver disease.

Background: Cystic fibrosis (CF) and CF-related liver disease can lead to disturbances in bile acid metabolism. This study determined serum bile acid concentrations in CF patients with different liver involvement to define their usefulness in differentiating liver disease advancement.

Methods: The study comprised three CF groups (each comprising 25 patients) with diagnosed liver cirrhosis, with other liver diseases, without liver disease, and 25 healthy subjects (HS). The levels of selected primary, secondary and conjugated bile acids, as well as the clinical expression of the disease were assessed.

Results: Bile acid levels were significantly higher in CF patients than in HS, except glycodeoxycholic acid (GDCA). However, bile acid concentrations did not differ between patients with liver cirrhosis

and other liver diseases. The levels of GDCA and deoxycholic acid (DCA) best differentiated CF patients with non-cirrhotic liver disease from those without liver disease (GDCA, AUC: 0.924, 95%CI 0.822–1.000, p<0.001; DCA, AUC: 0.867, 95%CI: 0.731–1.000, p<0.001). The principal component analysis of patients with cirrhosis and other liver diseases revealed that liver disease was related to GDCA concentration, GGTP activity, severe genotype and pancreatic insufficiency. Conclusions: The profile of serum bile acids in CF is differentiated and relates to liver disease. GDCA was proved to significantly differentiate patients with non-cirrhotic liver involvement from those with no detectable liver disease. Therefore, it is a potential marker of non-cirrhotic progression of liver disease in CF.

Abstract 11

Authors: Małgorzata Jamka, Edyta Mądry, Patrycja Krzyżanowska-Jankowska, Damian Skrypnik, Monika Szulińska, Radosław Mądry, Aleksandra Lisowska, Gulnara Batyrova, Monika Duś-Żuchowska, Anna Gotz-Więckowska, Paweł Bogdański, Jarosław Walkowiak

Title: The effect of endurance and endurance-strength training on body composition and cardiometabolic markers in abdominally obese women: a randomised trial.

Studies comparing the effect of endurance and endurance-strength training on cardiometabolic markers provided inconsistent results. Therefore, the study aimed to compare the effect of endurance and endurance-strength training on body composition and cardiometabolic parameters in abdominally obese women. In this randomised trial, 101 subjects were included and divided into endurance (n=52) and endurance-strength (n=49) training. During the 12-week intervention, participants performed supervised one-hour training three times a week. Body composition, blood pressure (BP), markers of glucose and lipid homeostasis, and myoglobin levels were measured before and after the intervention. In total, 85 subjects completed the trial. Both interventions decreased fat mass and visceral adipose tissue and increased free fat mass, appendicular lean mass index and lean mass index. Neither endurance training nor endurance-strength training affected glucose and lipid metabolism. However, only endurance training significantly decreased paraoxonase and myoglobin levels. Both training programmes significantly decreased BP, with a more reduction of diastolic BP noted in the endurance group. In conclusion, both training programmes had a favourable effect on body composition but did not improve glucose and lipid homeostasis. Besides, endurance training decreased paraoxonase activity and was more effective in reducing BP and also reduced myoglobin levels.

Abstract 12

Authors: Małgorzata Jamka, Edyta Mądry, Paweł Bogdański, Jakub Kryściak, Radosław Mądry, Aleksandra Lisowska, Elnara Ismagulova, Anna Gotz-Więckowska, Izabela Chudzicka-Strugała, Ainur Amanzholkyzy, Jarosław Walkowiak

Title: The effect of endurance and endurance-strength training on bone mineral density and content and physical capacity in abdominally obese women: a randomised trial.

The optimal type of exercises for preserving bone health, especially in obese women, is unknown, therefore, this parallel randomised trial aimed to compare the effect of endurance and endurance-strength training on bone mineral density (BMD) and content (BMC) as well as physical capacity in abdominally obese women. A total of 101 women were recruited and randomly assigned to endurance or endurance-strength training groups. Participants trained for 60 minutes per day, three times per week for 12 weeks. The endurance exercises were performed at an intensity of 50-75% of the maximum heart rate, whereas the strength exercises were at 50-60% of one-repetition maximum. Pre- and post-intervention BMD and BMC of the total body, lumbar spine and femoral neck were measured, with a graded exercise test (GXT) performed before and after the intervention period to assess physical capacity. In total, 44 in the endurance group and 41 in the endurance-strength group completed the study. Endurance training did not affect densitometric parameters, while there was a significant increase of BMD for the total body in the endurance-strength group. Both groups showed a significant increase in physical capacity parameters, systolic blood pressure (BP) at the ventilatory threshold and decrease diastolic BP measured before GXT. Moreover, there was a decrease in diastolic BP at the ventilatory threshold in the endurance-strength group. Besides, there was a significant difference between groups in BMC for the lumbar spine. In conclusion, endurance and endurance-strength training significantly improved physical capacity and did not differ in the effect on BMD. However, endurance training seems to be more effective in maintaining BMC at the lumbar spine.

Abstract 13

Authors: Ida Judyta Malesza, Michał Malesza, Jarosław Walkowiak, Nadiar Mussin, Dariusz Walkowiak, Raisa Aringazina, Joanna Bartkowiak-Wieczorek, Edyta Mądry

Title: Western-style high-fat diet, changes of the gut microbiota and inflammation – a chicken and egg situation.

The Western diet is a high-fat, low-carbohydrate one, where 45% of consumed calories are derived from fats and only 35% from carbohydrates. The latter is related to a shortage of high-quality carbohydrates, including fibre, and an unwelcome increase in refined sugar intake.

The ideal terms characterising the western nutrition pattern are overeating and frequent snacking. As a result, a modern human spends more than 16 hours a day in a postprandial state,

which is associated with a prolonged systemic low-grade inflammation, playing a crucial role in the development of civilization diseases. On the other hand, the literature provides a substantial body of evidence for the link between a high-fat diet (HFD) and gut microbiota alteration, enhancing a pro-inflammatory state. Additional studies have shown that fat per se can stimulate local and systemic inflammation.

This review addresses the state of the art of the causative relationship between pro-inflammatory milieu and gut microbiota changes in patients on an HFD. We discussed the molecular and metabolic aspects of HFD-driven dysbiosis and fat-derived inflammation in detail, trying to answer which came first, the chicken or the egg - dysbiosis or inflammation.

Abstract 14

Authors: Anna Skorczyk-Werner, Dorota Raczynska, Anna Wawrocka, Dinara Zholdybayeva, Nurgul Yakhiyayeva, Maciej Robert Krawczynski

Title: The coincidence of two ultra-rare hereditary eye diseases: gyrate atrophy and Kjer optic atrophy – a surprising diagnosis based on Next-Generation Sequencing.

Genetically determined ophthalmic diseases form a numerous and heterogenic group of disorders. Making the accurate clinical diagnosis of genetic eye disease is often a challenge for an ophthalmologist. In many cases, only genetic testing enables the establishment of the proper clinical diagnosis. Here we describe two ultra-rare diseases: gyrate atrophy of the choroid and retina (GACR) and Kjer-type optic atrophy coexisting in a 39-year-old Polish patient with severe visual impairment including a significant reduction of visual acuity and night blindness. Atrophic pigmented changes with large pigment deposits and chorioretinal atrophy with the retina's disturbed structure (with atrophic scarring changes and the epiretinal membrane) of both eyes were observed. Electroretinography (ERG) revealed extinguished responses. Next-Generation Sequencing (NGS) panel comprising 275 retinal genes revealed a presence of potentially pathogenic variants in two genes: a homozygous variant c.1058G>A (p.Gly353Asp) in the *OAT* gene and a heterozygous variant c.1886C>G (p.Ser629Ter) in *OPA1* gene. The diagnosis established based on NGS is surprising because initially, several different diagnoses were made, including high degenerative myopia, choroideremia, Leber congenital amaurosis, and severe, atypical retinitis pigmentosa. This report provides the unquestioned diagnostic value of the combination of chorioretinal imaging and the NGS technique. To our knowledge, this is the first and the only description of the coincidence of gyrate atrophy and Kjer-type optic atrophy.

Abstract 15

Authors: Piotr Celichowski, Karol Jopek Milecka Paulina, Marta Szyszka, Marianna Tyczewska, Svetlana Sakhanova, Witold Szaflarski, Ludwik K Malendowicz, Marcin Ruciński

Title: The extracellular Nampt (eNampt/Visfatin/PBEF) directly and indirectly stimulates ACTH and CCl2 protein secretion from isolated rat corticotropes.

Background: Nicotinamide phosphoribosyltransferase (Nampt/Visfatin/PBEF) acts both as an enzyme in NAD synthesis pathway as well as the extracellular hormone (eNampt). Among others, the eNampt exerts potent pro-inflammatory effects. Recently we have shown that in a rat, eNampt stimulates corticosterone secretion by acting through the pituitary rather than the hypothalamus.

Objectives: The aim of the present study was to investigate the mechanism of action of eNampt on secretion of ACTH and CCl2, one of the cytokines secreted by pituitary neuroendocrine tumors.

Material and Methods: The research was carried out on AtT-20 murine cell line, primary rat pituitary cell culture, isolated pituitary corticotropes, and in vivo. The research was carried out on AtT-20 murine cell line, primary rat pituitary cell culture, isolated pituitary corticotropes, and in vivo. The effects of the performed experiments were examined using the following methods: gene expression profiling by microarrays, qPCR, ELISA.

Results: The results of the study suggest that eNampt stimulates ACTH secretion from rat corticotropes both directly and indirectly. Indirect action most likely occurs through IL-6 secreted by folliculostellate cells of the pituitary gland. In isolated ACTH cells of the rat pituitary gland, eNampt stimulates the expression of genes involved in the immune response. Among them, the protein encoded by CCl2 gene seems to be also involved in the regulation of CRH-dependent metabolism. Unlike rat corticotropes, murine AtT-20 corticotropic cells do not react to either eNampt or Fk866 (the inhibitor of Nampt enzymatic action).

Conclusions: eNampt stimulate secretion of ACTH from rat corticotropes indirectly and directly, probably by stimulating Il-6 secretion from folliculostellate cells of the pituitary gland. This effect was not observed in AtT-20 corticotrophic cell cancer cell line.

Abstract 16

Authors: Paweł Uruski, Justyna Mikuła-Pietrasik, Martyna Pakuła, Sylwia Budkiewicz, Marcin Drzewiecki, Andrey N. Gaiday, Małgorzata Wierzowiecka, Eryk Naumowicz, Rafał Moszyński, Andrzej Tykarski, Krzysztof Książek

Title: Malignant ascites promote adhesion of ovarian cancer cells to peritoneal mesothelium and fibroblasts.

Although malignant ascites are known to contribute to various aspects of ovarian cancer progression, their role in adhesion of cancer cells to normal peritoneal cells is incomplete. Here

we compared the effect of malignant and benign ascites on the adhesion of A2780 and OVCAR-3 cancer cell lines to omentum-derived primary mesothelial cells (PMCs) and fibroblasts (PFBs). Results showed that malignant ascites stimulate adhesion of A2780 and OVCAR-3 cells to PMCs and PFBs more efficiently than benign ascites, and the strongest binding occurs when both cancer and normal cells were subjected to the fluid. Intervention studies showed that malignant ascites-promoted adhesion of A2780 cells to PMCs/PFBs depends on the presence TGF-β1 and HGF, whereas binding of OVCAR-3 cells was mediated by TGF-β1, GRO-1, and IGF-1. Moreover, malignant ascites up-regulated α5β1 integrins on PFBs but not PMCs or cancer cells, vimentin in all cells tested, and ICAM-1 in cancer cells only. When integrin-linked kinase was neutralized in PMCs or PFBs, cancer cell adhesion to PMCs and PFBs declined. Collectively, our report shows that malignant ascites may contribute to early steps of ovarian cancer metastasis by modulating proadhesive interplay between normal and cancer cells.

Abstract 17

Authors: Paweł Uruski, Agnieszka Sepetowska, Corinna Konieczna, Martyna Pakuła, Michał Wyrwa, Akylbek Tussupkaliyev, Andrzej Tykarski, Justyna Mikuła-Pietrasik, Krzysztof Książek

Title: Primary high-grade serous ovarian cancer cells are sensitive to senescence induced by carboplatin and paclitaxel *in vitro*.

Cancer cells undergo senescence in response to various chemotherapeutics, including carboplatin and paclitaxel, considered the golden standard in ovarian cancer management. Surprisingly, the effect of these drugs on ovarian cancer cell senescence is unknown. Here we show that carboplatin applied together with paclitaxel induces senescence in ovarian cancer cells in vitro. This activity was reflected by a permanent G2/M growth arrest, high fraction of cells expressing senescence biomarkers (SA-β-Gal, γ-H2A.X), an up-regulated expression of p16, p21, and p53 proteins, and decreased expression of cyclin B1. Neither telomere length nor telomerase activity change in senescent cells, and the majority of DNA damage localized outside telomeres. Moreover, drug-treated cancer cells exhibited increased protein and hyperphosphorylation of STAT3, overproduced superoxides and peroxides, and increased mitochondria mass. They were also portrayed by up-regulated ANG1, CCL11, IL-6, PDGF-D, TIMP-3, TSP-1, and TGF-β1 at mRNA and/or protein level. Collectively, our findings imply that a conventional chemotherapy may elicit senescence in ovarian cancer cells, which may translate to the development of cancer-promoting phenotype, despite their inability to divide.

TASK 2

"Improvement of educational process and educational programs in the clinical pharmacology and oncology: oncological laboratory diagnostics disciplines"

TASK 2A

"Improvement of educational process and educational programs in the Clinical pharmacology discipline"

SUBTASK 2A1

"Development of undergraduate educational program for the "Clinical Pharmacology" discipline"

Task Leader:	Assoc. Prof. Marzena Dworacka
Subtask supervisor:	Assoc. Prof. Marzena Dworacka
Key-experts:	Assoc. Prof. Marzena Dworacka Assoc. Prof. Hanna Winiarska
Status :	100 % completion
Duration of activity:	June 2019 – September 2020
Output:	(1) The review of the current program in clinical pharmacology at the WKMOMU. (2) Training seminar materials. Report on the seminar. (3) The proposal of the modernized program in clinical pharmacology for undergraduate students.

1.THE REVIEW OF THE CURRENT PROGRAM IN CLINICAL PHARMACOLOGY AT THE WKSMU (currently WKMOMU) AND THE DEVELOPMENT OF THE MODERNIZED PROGRAM IN CLINICAL PHARMACOLOGY FOR UNDERGRADUATE STUDENTS

Before the project initiation, in the academic year 2017/18, there were no separate courses covering clinical pharmacology issues for undergraduate students at the WKMOMU. Clinical pharmacology was only a part of the course of internal medicine. Considering that clinical pharmacology is necessary for the development of personalized medicine, it was crucial to introduce a separate undergraduate course on clinical pharmacology. The current curricula (from academic years 2019/2020 and 2020/2021) for clinical pharmacology as well as for basic (general) pharmacology for undergraduate students were evaluated and their reviews were ultimately prepared. The results, including all the essential details and conclusions are presented in the attached documents.

Comment:

The evaluation process was hindered by very frequent and unexpected changes in the current curricula at WKMOMU within the academic year and between subsequent academic years, in the course of the project duration. Therefore the review was prepared twice (at first for general practice specialty and ultimately for internal medicine specialty). The attached document contains the review of the last version of programs provided by WKMOMU. The evaluation of clinical pharmacology course at the WKMOMU considers its content both in terms of quantity and quality (type) of teaching, the evaluation of facilities and methods.

Moreover, 4 on-line meetings and one direct meeting with the WKMOMU teaching staff members allowed for an in-depth analysis of all prerequisites, issues and expectations associated with the medical students education covering clinical pharmacology at WKMOMU. The direct meeting with the WKMOMU specialists at WKMOMU in October 2019 resulted in discuss their current educational program, their needs and expectations. It's a pity that it wasn't possible to do it with a contribution of a person responsible at WKMOMU for clinical pharmacology course and its program. During this visit in Aktobe, PUMS experts had a chance to attend some classes.

Reports from each meeting were included into the quarterly reports. The proposal of the modernized program in clinical pharmacology for undergraduate students was prepared, as well, the road map helpful for the new curriculum implementation. The primary version of the curriculum and the road map was provided to WKMOMU in October 2020.

The review of the current program in clinical pharmacology at the WKMOMU is presented in the attachment titled "2A1-review and program".

Training seminar materials were provided to WKMOMU after on-line seminar in July 2020. Report on the seminar was included into the quarterly report.

The proposal of the modernized program in clinical pharmacology for undergraduate students is presented in the attachment 2A1-I.

The road map for the program modernization is presented in the attachment 2A1-II.

SUBTASK 2A2

"Involvement of partnering University faculty to conduct lectures and workshops at all levels of education of specialists in clinical pharmacology"

Task Leader:	Assoc. Prof. Marzena Dworacka
Subtask supervisor:	Assoc. Prof. Marzena Dworacka
Experts, including non key-experts:	Assoc. Prof. Marzena Dworacka
	Assoc. Prof. Hanna Winiarska
	Prof. Przemysław Mikołajczak
	Assoc. Prof. Edyta Szałek
	Prof. Franciszek Główka
	Assoc. Prof. Marta Karaźniewicz-Łada
	Dr. Anna Wesołowska
	Dr. Magdalena Borowska
	Dr. Renata Forjasz
	Assoc. Prof. Katarzyna Kosicka
	Assoc. Prof. Danuta Szkutnik-Fiedler
Status :	100 % completion
Duration of activity:	June 2019 - February 2021
Output:	(1) Clinical Pharmacology in Practice – educational program - 6 series of lectures/workshops/seminars conducted in PUMS or at the WKMOMU;
	(2) Training seminars/lectures/workshops materials. Lecture/seminars presentations.
	(3) The report.

1.LECTURES AND WORKSHOPS IN CLINICAL PHARMACOLOGY

Clinical Pharmacology in Practice - six extensive direct training courses were conducted.

This training course was intended for clinical and general pharmacology specialists (all topics), undergraduate students (selected topics), residents in clinical pharmacology (all topics) as well as for physicians of other specialties, such as internal medicine, surgery, endocrinology, ophthalmology, pediatrics, family medicine specialists (selected topics).

The first training entitled "Basics of clinical pharmacology" was held in Aktobe at WKMOMU in October 2019, whereas the subsequent one, entitled "Advanced pharmacokinetics and clinical pharmacology in practice I" was held in Poznań at PUMS in December 2019.

Due to the amendments in the project forced by the pandemic, all subsequent training courses entitled "Advanced pharmacokinetics and clinical pharmacology in practice II-IV" were conducted on-line by means of the Teams platform in April, October, November, December 2020 as well as in February and January 2021.

All presentations and supplementary materials included in the training courses were delivered to the WKMOMU teaching staff members attending the courses. The reports from the training courses were delivered quarterly.

The program of direct training courses was performed to cover all topics which should be included into the education process of clinical pharmacology specialists at WKMOMU and which were not included in the programs for the residency in clinical pharmacology (on the basis of our analysis provided to the Rector of WKMOMU in 2017). The program of the courses also covers many topics mandatory for the undergraduate education of medical students but excluded from the current curriculum (reviewed in the frame of task 2A1).

Training course I and the majority of the training course II were focused on the topics essential for clinical pharmacology specialists and residents. Some of these topics, such as advanced pharmacokinetics, therapeutic drugs monitoring, biosimilarity are hardly addressed by WKMOMU clinical pharmacology specialists , which may be because the therapeutic protocols incorporating these skills and knowledge have not been established. It is also not technically possible to conduct therapeutic drug monitoring, which is a mandatory requirement in the hospital setting in modern medical centers.

The second part of the training course II and nearly half of the training course III were focused on the individualization of pharmacotherapy as the element of personalized medicine. Additionally, the other half of the training course III, as well as training courses IV and V contained all the most up-to-date data, recommendations and guidelines regarding the modern pharmacotherapy of cardiovascular diseases, infections, metabolic disorders, diagnosis and monitoring of drugs-induced adverse effects. The participants of the courses also explored modern knowledge in the area of clinical pharmacology, e.g. concerning the use of drugs via enteral tubes, pharmacological protection in oncology, pharmacology in ophthalmology.

2.**CLINICAL PHARMACOLOGY IN PRACTICE CURRICULUM (PROGRAM)**

I. Principles of clinical pharmacology.

1. Absorption and disposition kinetics. Basic model for drugs absorption and disposition. Intravenous dose.
   F. Główka
2. Absorption and disposition kinetics. Extravascular dose.
   F. Główka
3. Factors affecting drugs absorption, distribution, metabolism and elimination – part I. F. Główka
4. Factors affecting drugs absorption, distribution, metabolism and elimination – part II. F. Główka
5. Therapeutic response and toxicity.
   F. Główka

II. Advanced pharmacokinetics and clinical pharmacology in practice I.

1. Linear and non-linear pharmacokinetics. Capacity limited kinetics.
   M. Karaźniewicz-Łada
2. Single and multiple-dose regimens, steady state.
   K. Kosicka
3. Linear and non-linear pharmacokinetics. Capacity limited kinetics. Single and multiple-dose regimens, steady state.
   K. Kosicka
4. Methods for assessing bioavailability. First pass clearance. Bioequivalence studies, generic and reference drug product. Therapeutic bioequivalence. Bioavailability versus bioequivalence Biosimilarity assessment.
   E. Szałek
5. Clinical trials. The safety of drug in clinical trials.
   E. Szałek
6. Chronopharmacology.
   D. Szkutnik-Fiedler
7. Therapeutic drug monitoring. Part I
   M. Karaźniewicz-Łada
8. Therapeutic drug monitoring. Part II
   K. Kosicka
9. Therapeutic drug monitoring. Part III

K. Kosicka

10. Drug-to-drug interactions. Principles and mechanisms.
    P. Mikołajczak.
11. Drug-alcohol interactions.
    P. Mikołajczak.
12. Drug interactions analysis in cancer patients (with particular emphasis on the TKIs interactions).
    E.Szałek
13. Drug dose individualization.
    M. Karaźniewicz-Łada
14. Dose adjustment in renal diseases.
    D. Szkutnik-Fiedler
15. Dose adjustment in hepatic diseases.
    D. Szkutnik-Fiedler

III. Advanced pharmacokinetics and clinical pharmacology in practice II.

1. Intravenous dose – cases and calculations.
   K. Kosicka
2. Pharmacokinetics of biologics. Part I (continued as an e-learning material)
   K. Kosicka
3. Practical aspects of pediatric pharmacology.
   D. Szkutnik-Fiedler
4. Practical aspects of geriatric pharmacology.
   D. Szkutnik-Fiedler
5. Opioids – the current knowledge.
   R. Forjasz
6. NSAIDs – their role in the current pharmacotherapy – limits and benefits.
   R. Forjasz
7. Drugs affecting coagulation – the current point of view. Drug-to-drug interactions. Part I.
   R. Forjasz
8. Drugs affecting coagulation – the current point of view. Drug-to-drug interactions. Part II.
   R. Forjasz
9. Cardiovascular pharmacology. New recommendations in pharmacotherapy of hypertension.
   A. Wesołowska
10. Principles of pharmacogenetics.
    P. Mikołajczak.

11. Indications for genetic test to individualize pharmacotherapy.
    P. Mikołajczak.

IV. Clinical pharmacology in practice III.

1. Sources of drug information.
   A. Wesołowska
2. Cardiovascular pharmacology. Pharmacotherapy of the coronary heart disease.
   M. Borowska
3. Antiarrhythmic agents. The current perspective regarding their safety.
   A. Wesołowska
4. Antimicrobials – beta-lactams, their current role and limitations in the therapy.
   M. Borowska
5. Antimicrobials – macrolides and ketolides their current role and limitations in the therapy.
   M. Borowska
6. Antimicrobials – quinolones, their current role and limitations in the therapy.
   M. Borowska
7. Interactions between drugs and laboratory tests results.
   M. Borowska
8. Food-drug interactions.
   M. Borowska
9. Drug-induced adverse reactions – mechanisms.
   M. Dworacka
10. Drug-induced allergic reactions.
    M. Dworacka
11. The use of drugs in patients with enteral feeding tubes.
    M. Dworacka

V. Clinical pharmacology in practice IV.

1. Pharmacotherapy of emergencies: supportive drugs used in the course of chemo- and radiotherapy.
   R. Forjasz
2. Pharmacotherapy of eye disorders.
   R. Forjasz
3. Pharmacotherapy of the metabolic diseases. Diabetes mellitus – current trends.
   M. Dworacka

4. Pharmacotherapy of the metabolic diseases. Glucorticosteroids – principles of their proper use.
   H. Winiarska
5. Pharmacotherapy of hyperlipidemia.
   M. Dworacka
6. Pharmacotherapy of the metabolic diseases. Progress in pharmacotherapy of osteoporosis.
   H. Winiarska
7. Pharmacotherapy of the metabolic diseases. Current trends in gout and hyperuricemia treatment.
   H. Winiarska
8. Antimicrobials used in hospital conditions. Pharmacology. Limitations. Antibiotics use for prophylaxis.
   H. Winiarska
9. Antimicrobials. Pharmacokinetic/ pharmacodynamic relationships of antimicrobial drugs. Pharmacotherapy of C.difficile infection.
   M. Dworacka

SUBTASK 2A3

"Development of collaborative online learning programs (courses, cycles) for students in the "Clinical pharmacology" discipline"

Task Leader:	Assoc. Prof. Marzena Dworacka
Subtask supervisor:	Assoc. Prof. Marzena Dworacka
Experts, including non key-experts:	Assoc. Prof. Marzena Dworacka
	Assoc. Prof. Hanna Winiarska
	Prof. Przemysław Mikołajczak
	Assoc. Prof. Edyta Szałek
	Prof. Franciszek Główka
	Assoc. Prof. Marta Karaźniewicz-Łada
	Dr. Renata Forjasz
	Dr. Katarzyna Manikowska
	Dr. Beata Buraczyńska-Andrzejewska
	Mr. Kacper Stypczyński
Status :	100 % completion
Duration of activity:	June 2019 - March 2021
Output:	(1) On-line program: three on-line courses (cycles) of training in the field of clinical pharmacology
	(2) Training seminars/lectures/workshops materials.

1.DEVELOPMENT OF COLLABORATIVE ONLINE LEARNING PROGRAMS

Three e-learning courses intended for clinical and general pharmacology specialists, residents, undergraduate students, as well as for physicians of other specialties were created and submitted to the WKMOMU for upload and use on the Moodle platform.

PUMS expert - Beata Buraczyńska-Andrzejewska was in charge of the supervision of e-learning potential in the area of clinical pharmacology, whereas Kacper Stypczyński was responsible for the technical support and processing of all of e-learning materials.

Moreover, within several months Beata Buraczyńska-Andrzejewska and Kacper Stypczyński conducted several on-line meetings with the WKMOMU IT staff who were completely unprepared and untrained in the management and technical handling of e-learning materials. The additional problem was their absolute inability to communicate in English which constituted a real challenge for the non-professional translators, taking into consideration the very specific vocabulary of IT processes.

All e-learning courses present a range of topics complementary to those covered on-line in real time, e.g. cardiovascular pharmacology, antimicrobials, advanced pharmacokinetics. They also address the issues of clinical pharmacology which have not been sufficiently covered in protocols used in the Republic of Kazakhstan, i.e. issues regarding the principles of pain treatment, or topics which are not widely discussed during pharmacology courses, e.g. toxicology. In addition, several e-learning materials have been prepared covering topics specific to clinical pharmacology and relevant for practical purposes, e.g. pharmacovigilance, pharmaco-epidemiology.

The e-learning materials from the lectures or seminars have not been developed in the paper form, since every e-learning material prepared within the project represented a whole which includes self-assessment and supplementary materials, and thus require listening comprehension on the part of the participants.

2.ON-LINE PROGRAMS ON CLINICAL PHARMACOLOGY (E-LEARNING COURSES)

I. Clinical pharmacology in practice V.

1. Absorption and disposition kinetics. Basic model for drugs absorption and disposition. Extravascular dose. Cases and training.
   F. Główka
2. Dose adjustment in renal diseases – cases and calculations.
   M. Karażniewicz-Łada
3. Pharmacokinetics of biologics. Part II.
   M. Karażniewicz-Łada
4. Pharmacoepidemiology.
   M. Dworacka
5. Pharmacotherapy of pain.
   M. Dworacka

II. Clinical pharmacology in practice VI.

1. Safety of drugs during pregnancy.
   E.Szałek
2. Safety of drugs during lactation.
   E.Szałek
3. Pharmacokinetic / pharmacodynamic relationships of antimicrobial drugs (case studies for antibacterial and antifungal drugs).
   E. Szałek
4. Pharmacovigilance.
   H. Winiarska
5. Pharmacotherapy of heart failure – the modern point of view.
   H. Winiarska

III. Clinical pharmacology in practice VII.

1. Practical aspects of pharmacotherapy of anxiety.
   K. Manikowska
2. New concepts in migraine pharmacotherapy.
   K. Manikowska
3. Medical marijuana - hopes and challenges.
   P. Mikołajczak
4. Drug poisoning and pharmacotherapy.
   P. Mikołajczak

TASK 2B

"Improvement of educational process and educational programs in the Oncology: oncological laboratory diagnostics discipline"

SUBTASK 2B1

"Development of educational program for the Oncology: Oncological Laboratory Diagnostics discipline"

Task Leader:	Assoc. Prof. Ewa Wysocka
Subtask supervisor:	Assoc. Prof. Ewa Wysocka
Key-experts:	Assoc. Prof. Ewa Wysocka Prof. Sławomir Michalak
Status :	100 % completion
Duration of activity:	June 2019 – September 2020
Output:	(1) The review of the current educational model for laboratory diagnostics at the WKSMU (WKMOMU), with special focus on content related to oncological laboratory diagnostics. (2) Proposal of the modernized program for undergraduate medical students in laboratory diagnostics, including oncological laboratory diagnostics. (3) Training seminar materials. Report on the training performed at the WKSMU (WKMOMU) by PUMS experts.

1.THE REVIEW OF THE CURRENT EDUCATIONAL MODEL FOR LABORATORY DIAGNOSTICS AT THE WKSMU (CURRENTLY WKMOMU) AND THE DEVELOPMENT OF THE MODERNIZED PROGRAM IN LABORATORY DIAGNOSTICS, INCLUDING ONCOLOGICAL LABORATORY DIAGNOSTICS FOR UNDERGRADUATE STUDENTS

The previous curriculum for medical doctors was provided to PUMS experts. The ongoing changes were also presented. Many courses were searched for the elements of laboratory diagnostics, including biochemistry, molecular biology, histology, immunology, microbiology, pathology (pathophysiology and pathomorphology), internal medicine, and its sub-disciplines, hematology, pediatrics, gynecology, surgery and oncology, and other topics, if relevant. Most of the syllabi were translated into English and sent to PUMS experts. However, not all new syllabi and their English counterparts were finally confirmed and made available.

Raisa A. Aringazina was established the coordinator of Task 2B at the WKMOMU.

Task Leader and the WKMOMU coordinator of Task 2B visited the relevant departments of basic and clinical sciences, presented teaching activities for the selected aspects of laboratory diagnostics at different stages of the discipline. Strengths and weaknesses of the current educational process for laboratory medicine at the WKMOMU were considered during the discussions with the heads of the departments, academic teachers and students. Laboratory Diagnostics classes were not scheduled at that time and, therefore, could not be visited and evaluated.

The existing and the developing curriculum on laboratory diagnostics, as well as the issues relevant for laboratory diagnostics and oncological laboratory diagnostics, were evaluated. The necessary details, such as the subject content, the quantity and quality (type) of teaching hours, and the teaching methods were reviewed.

PUMS experts searched and analyzed the selected European and global undergraduate educational programs for medical doctors with regard to laboratory diagnostics and laboratory medicine. They analyzed PUMS experiences in the development of the undergraduate educational process and program for medical doctors, concerning laboratory medicine and laboratory diagnostics. A comparison between PUMS/European/global standards and the WKMOMU (Kazakh) regulations for the medical curriculum, including laboratory diagnostics, was performed.

PUMS expert Sławomir Michalak presented the basis of the modern educational process in laboratory medicine to the WKMOMU specialists, including the on-line lecture “Innovative methods in laboratory medicine teaching."

The results were discussed during meetings with the WKMOMU staff, including on-line meetings (seminars). Conclusions were presented with the periodic reports and the Preliminary Report.

The results of the evaluation of the current curriculum, including laboratory diagnostics and issues relevant for the oncological laboratory diagnostics, were regularly provided to Task 2B key-experts, and were subsequently taken into account during the implementation of Task 2B2 and 2B3.

The COVID-19 pandemic halted the Project Participants' visits to the WKMOMU and PUMS, and made it difficult to experience the medical education process at both universities.

However, the WKMOMU teachers managed to attend several lectures and practical classes at the Department of Laboratory Diagnostics, the Department of Pathology, and the Department of Clinical Pathology and Immunology, to be able to comply with the modern laboratory medicine and the modern educational model at PUMS.

The proposal of the modernized program in laboratory diagnostics for undergraduate students is presented in the attachment 2B1-I.

The road map for the program modernization is presented in the attachment 2B1-II.

SUBTASK 2B2

"Involvement of partnering University faculty to conduct lectures and workshops at all levels of education of specialists in Oncology: oncological laboratory diagnostics"

Task Leader:	Assoc. Prof. Ewa Wysocka
Subtask supervisor:	Assoc. Prof. Ewa Wysocka
KEY-Experts:	Assoc. Prof. Ewa Wysocka
	Prof. Sławomir Michalak
	Assoc. Prof. Szczepan Cofta
	Prof. Grzegorz Dworacki
	Prof. Dariusz Iżycki
	Prof. Maciej Krawczyński
	Dr. Paweł Kurzawa
	Prof. Rodryg Ramlau
Status :	100 % completion
Duration of activity:	June 2019 - March 2021
Output:	(1) Oncological laboratory diagnostics – educational program – 8 series of lectures/workshops/seminars conducted in PUMS or at the WKMOMU;
	(2) Training seminars/lectures/workshops materials. Lecture/seminars presentations.
	(3) The report.

1.LECTURES AND WORKSHOPS IN ONCOLOGICAL LABORATORY DIAGNOSTICS

Eight trainings were prepared and performed, and they have been relevant for the undergraduate medical students, as well as for the physicians at various levels of their postgraduate education.

A number of the topics have been developed. Basic and advanced issues of laboratory diagnostics and oncological laboratory diagnostics have been presented. These should improve the undergraduate educational program and the clinical practice of general practitioners and specialists, who would be able to conduct a differential diagnosis and/or monitor the oncological patients. Some issues should supplement the postgraduate curriculum of the oncological specialty.

Taking into account the findings of phase 1 of Task 2B.1, a list of participants for Training 1 was established, including the WKMOMU coordinator for Task 2B. The lists of participants in the subsequent trainings to be invited to PUMS, were successively established.

Training I and II were held at PUMS in December 2019 and February 2020, respectively.

According to the amendments to the Project, due to the COVID-19 pandemic, the next trainings were performed on-line, on TEAMS platform, with no limit access for the WKMOMU participants.

Trainings were planned to show some important aspects in laboratory medicine and the ways of preparing and addressing the issues.

The WKMOMU teachers had the opportunity to discuss the aspects during meetings, and some of them actively participated in the classes.

2.THE TRAINING COURSES IN ONCOLOGICAL LABORATORY DIAGNOSTICS

I. Principles of laboratory medicine (blood, urine and other body fluids) in clinical practice. Laboratory techniques: traditional methods and advanced technologies. Clinical and laboratory aspects of selection and interpretation of laboratory tests.

1. Clinical chemistry and its role in modern medicine.
   S. Michalak
2. Biochemical effects of a systemic malignancy. Interpretation of laboratory tests in cancer patients. Part 1.
   S. Michalak
3. Biochemical effects of a systemic malignancy. Interpretation of laboratory tests in cancer patients. Part 2.
   S. Michalak
4. Basics of laboratory diagnostics. Selected factors influencing a laboratory test result.
   E. Wysocka
5. Principles of laboratory medicine for a differential diagnosis of anemia.
   E. Wysocka
6. The organization of oncology centers – Polish experiences in multidisciplinary clinical procedures.
   R. Ramlau
7. Reinvestment of a systemic therapy for oncological patients in Poland according to the European standards of healthcare.
   R. Ramlau
8. New immunological and molecular markers in cancer – focus on the colorectal cancer.
   D. Iżycki,
9. Immunotherapy of metastatic colorectal cancer – contemporary challenge for laboratory medicine.
   D. Iżycki
10. Clinical and biochemical aspects of selection and interpretation of laboratory tests – laboratory medicine for metabolic disorders.
    E.Wysocka
11. Principles of laboratory medicine in hemostasis disorders – traditional and advanced methods.
    E. Wysocka

II. Pathology department activities in the clinical practice – part 1. Traditional methods and advanced technologies. Principles of flow cytometry and its clinical application. Pathology report for the proper therapy.

1. Flow cytometry principles and applications.
   G. Dworacki
2. Flow cytometry in lymphoproliferative disorders.
   G. Dworacki
3. Flow cytometry in myeloproliferative disorders.
   G. Dworacki
4. Intraductal proliferation of the breast and the use of immunohistochemistry technique in a differential diagnosis.
   P. Kurzawa
5. Atypical intraductal proliferation of the breast and the use of immunohistochemistry technique in a differential diagnosis.
   P. Kurzawa
6. Cooperation between pathologist and clinician, including oncological diagnosis. Pathology report for the clinical use.
   P. Kurzawa
7. Dissection of the surgical specimen and the use of immunohistochemistry technique in daily practice. Pathology report for the clinical use.
   P. Kurzawa

III. Pathology department activities for clinical practice – part 2. Pathology Clinical Practice Guidelines. Pathology report for the proper therapy. Clinical case analysis.

1. Structure and organization of work at the Pathology Department.
   P. Kurzawa
2. Grossing, description, and dissecting of most common surgical specimens.
   P. Kurzawa
3. Principles of cancer biology, drug development and therapy.
   D. Iżycki
4. Benign lesions of the breast: how to make a diagnosis - with or without immunohistochemistry.
   P. Kurzawa
5. Case reports - breast cancer, colon cancer, ovarian cancer.
   D. Iżycki
6. Malignant lesions of the breast: how to make a diagnosis - with or without immunohistochemistry.
   P. Kurzawa
7. In-house cases you may come across in your daily practice.
   P. Kurzawa
8. How to make a diagnosis based on the cytology of the breast, thyroid, or lungs.

P. Kurzawa

9. Pathology of the cervix, vulva, and vagina and how to use additional stains to reach the diagnosis.
   P. Kurzawa
10. Pathology of the uterus with additional stains to reach the diagnosis.
    P. Kurzawa
11. Pathology of the ovary and the difficult gynecology cases in daily practice.
    P. Kurzawa
12. Selected GI problems in the pathology of the stomach. Neuroendocrine tumors.
    P. Kurzawa
13. Histochemical, immunohistochemical, and molecular techniques used in Daily practice and Hematopathology.
    P. Kurzawa

IV. Clinical case analysis: how to prevent, diagnose and monitor diseases – part 1. Early diagnosis of a neoplasm. Personalized cancer medicine. Paraneoplastic syndromes.
Techniques to improve lectures, seminars and workshops in the educational process. WKMOMU academic teachers could conduct classes and undergo expert assessment.

1. Immunology and immunotherapy of cancer.
   D. Iżycki
2. Immunotherapy of colon cancer – biomarkers we can use for diagnosis and treatment. Part1.
   D. Iżycki
3. Immunotherapy of colon cancer – biomarkers we can use for diagnosis and treatment. Part2.
   D. Iżycki
4. Paraneoplastic syndromes as early manifestation of systemic malignancy.
   S. Michalak
5. Pathomechanisms underlying paraneoplastic syndromes – translation into clinical practice.
   S. Michalak
6. Paraneoplastic syndrome? What next? Algorithms in search of cancer.
   S. Michalak

V. Clinical and laboratory aspects of selection and interpretation of laboratory tests. Diagnostic test panels (profiles) and individual laboratory test for different medical conditions. Diagnostic meaning of neoplastic markers. Molecular biology for oncological laboratory diagnostics – genetic testing.

1. Cancerogenesis. Hereditary cancers and their molecular diagnosis.
   M. Krawczyński
2. Retinoblastoma and phacomatoses.

M. Krawczyński

3. Hereditary breast and ovarian cancer.
   M. Krawczyński
4. Hereditary colorectal cancer.
   M. Krawczyński
5. Multiple endocrine neoplasia.
   M. Krawczyński
6. DNA repair genes and hereditary cancers.
   M. Krawczyński
7. Laboratory test panel – towards a differential diagnosis of diseases.
   E. Wysocka
8. Neoplastic markers in the clinical practice.
   E. Wysocka
9. Clinical and laboratory aspects of the selection and interpretation of laboratory tests in respiratory diseases. Part 1.
   S. Cofta
10. Clinical and laboratory aspects of the selection and interpretation of laboratory tests in respiratory diseases. Part 2.
    S. Cofta

VI. Clinical and laboratory aspects of selection and interpretation of laboratory tests. Diagnostic test panels (profiles) and individual laboratory test for different medical conditions. Laboratory tests measuring systemic disease's advancement, including systemic assessment of a neoplastic disease. Diagnostic meaning of neoplastic markers. Part I.

1. Diagnostic meaning of the circulating tumor markers.
   E. Wysocka
2. Routine laboratory diagnostics of the inflammatory process – blood cells.
   E. Wysocka
3. Routine laboratory diagnostics of the inflammatory process – serum markers.
   E. Wysocka
4. Laboratory diagnostics of the inflammatory process in the clinical practice.
   E. Wysocka
5. Hypercoagulability in the course of a systemic malignancy.
   S. Michalak

VII. Clinical and laboratory aspects of selection and interpretation of laboratory tests. Diagnostic test panels (profiles) and individual laboratory test for different medical conditions. Laboratory

tests measuring systemic disease's advancement, including systemic assessment of a neoplastic disease. Diagnostic meaning of neoplastic markers. Part II.

1. Indicators of malignancy in body fluids laboratory analyzes.
   S. Michalak
2. Cachexia – how to evaluate nutritional state in oncological patients.
   S. Michalak
3. Clinical cases of breast cancer – the role of the multidisciplinary unit.
   D. Iżycki
4. Basics of pulmonological oncology. Non-small cell lung cancer – a case report.
   D. Iżycki
5. Laboratory medicine for differential diagnosis – a consultation with a pulmonologist.
   S. Cofta
6. Frequent and rare diagnoses in respiratory medicine – do we need laboratory diagnostics?
   S. Cofta

VIII. Clinical case analysis: how to prevent, diagnose and monitor diseases – part 2. Early diagnosis of a neoplasm. Personalized cancer medicine. Advanced neoplastic disease. Techniques to improve lectures, seminars and workshops in the educational process.

1. Differential diagnosis of dyspnea – the role of laboratory diagnostics.
   S. Cofta
2. Early diagnosis of a neoplasm – clinical and laboratory manifestation of a neoplastic disease.
   E. Wysocka
3. Blood gas analysis and acid-base balance in clinical practice.
   E. Wysocka
4. Respiratory failure – from pathology to clinical practice.
   S. Cofta
5. Laboratory diagnostics and the strategy of clinical management on the basis of the selected diseases (i.e. urinary system diseases).
   E. Wysocka
6. Advanced neoplastic disease and optimal clinical management, including palliative care.
   S. Cofta

SUBTASK 2B3

"Development of collaborative online learning programs (courses, cycles) for students in the Oncology: oncological laboratory diagnostics discipline"

Task Leader:	Assoc. Prof. Ewa Wysocka
Subtask supervisor:	Assoc. Prof. Ewa Wysocka
Key-Experts:	Assoc. Prof. Ewa Wysocka
	Prof. Sławomir Michalak
	Prof. Rodryg Ramlau
	Prof. Dariusz Iżycki
	Dr. Paweł Kurzawa
	Dr. Beata Buraczyńska-Andrzejewska
	Mr. Kacper Stypczyński
Status :	100 % completion
Duration of activity:	June 2019 - March 2021
Output:	(1) On-line program: three on-line courses (cycles) of training in oncology laboratory diagnostics
	(2) Training seminars/lectures/workshops materials.

1.DEVELOPMENT OF COLLABORATIVE ONLINE LEARNING PROGRAMS

The e-learning lectures present basic topics and advanced issues in the field of laboratory diagnostics and oncological laboratory diagnostics which should be added in order to improve both the undergraduate curriculum and the continuing education program for those who graduated from the medical university in the Republic of Kazakhstan.

PUMS expert Beata Buraczyńska-Andrzejewska supervised the e-learning presentation process in laboratory diagnostics, whereas Kacper Stypczyński was responsible for the technical service and processing of all of e-learning materials.

The visits of the WKMOMU staff at PUMS to learn and practice the e-learning techniques were replaced by on-line activities due to the COVID-19 pandemic. Nevertheless, the process of transferring e-learning lectures and implementing the on-line education to the WKMOMU was severely disturbed by the insufficient knowledge of the English language by IT technicians at the WKMOMU.

Rodryg Ramlau participated in preparing the clinical background for on-line courses and supervised the disclosure procedure of the clinical data regarding cancer patients at PUMS.

Ewa Wysocka evaluated formatively all e-learning lectures and tested their final version.

Lectures/workshops were prepared and delivered using the Moodle platform.

The e-learning materials were received by the WKMOMU.

2. ON-LINE LEARNING COURSES ON LABORATORY DIAGNOSTICS AND ONCOLOGICAL LABORATORY DIAGNOSTICS (E-LEARNING COURSES)

1. Routine laboratory tests in oncological patients - from pathomechanisms to interpretation.
   S. Michalak
2. Laboratory diagnostics of the selected metabolic disorders in oncological patients – from basic science to the clinical practice.
   E. Wysocka
3. Basic procedures in the Department of Pathology.
   P. Kurzawa
4. Autoantibodies as tumor markers – a novel insight in anticancer immunity.
   S. Michalak
5. Principles of Breast Pathology – benign lesions.
   P. Kurzawa
6. Renal cell carcinoma – clinical practice, diagnosis, treatment and follow-up.
   D. Iżycki
7. Treatment options in advanced renal cell carcinoma based on the case report.
   D. Iżycki

ATTACHMENTS

Attachment 1A.1 – I

The improvement plan for the undergraduate programs of medical education at the WKMOMU

Following a detailed analysis of the current curriculum at the WKMOMU including the documents sent and the observations made during the visits, we have come to the conclusion that the duration of studies and the number of credits should be adjusted to the standards applied in the European universities. Medical studies should last 6 years (12 semesters) and should be followed by a 1-year clinical internship. The curriculum should include at least 5700 hours of contact activities with the teachers, and, moreover, a sufficient amount of additional self-study time.

Credits from the Kazakh compulsory component, as described in detail in the following document, should be included in the number of the credits only if the content of the component is related to the standard learning outcomes.

We do not recommend including social and linguistic disciplines (except for English as a foreign language) and physical education in the number of ECTS credits necessary for the completion of the medical studies.

Graduate profile

To obtain efficient program the graduate profile has been described comprising the desired features of the alumni of the medical studies. The profile has been included in the separate document attached to the Improvement plan (Graduate profile).

The graduate is equipped with the knowledge and skills enlisted in the document and having received all necessary credits and having passed all the exams included in the program of studies, receives the title of a medical doctor. Moreover, the graduate can start the postgraduate training in the chosen medical specialty according to the local legal regulations. The program is designed to enable the mobility of students to other universities as part of the exchange programs during the studies.

Types of teaching

In the course of clinical science education, students should have direct access to patients, including outpatients with acute and chronic diseases, relevant for the learning content assigned to the classes or groups of classes.

The curriculum should allow the student to choose elective classes according to their interest with assigned ECTS points of at least 3% of the number of ECTS credits required for graduation.
The list of elective courses should include issues from basic and preclinical sciences as well as clinical sciences prepared by the teaching staff of WKMOMU with the specified learning outcomes which can be obtained and the method of evaluation.
The number of ECTS credits that can be earned in terms of methods and techniques of remote learning may not be more than 20% of the number of ECTS credits needed to complete their studies. However, remote learning methods should be used according to the current epidemiological circumstances if other methods of teaching are not available due to epidemiological reasons.

The Kazakh compulsory component

In our opinion Kazakh compulsory component contains too many issues not connected to the medical studies, i.e. Modern History of Kazakhstan. Therefore, the credits from these subjects and the amount of time attributed to them should not be included in the medical curriculum. Only the selected subjects with learning outcomes directly related to the medical curriculum from the obligatory component should be included in the medical program, since they do not match the learning outcomes of the medical studies. Issues not related to the medical program should be covered outside the curriculum as additional ECTS credits.
Another suggestion would be the implementation of compulsory component in the secondary education which could be considered by the Kazakh authorities.

Summer professional training

We strongly advise obligatory summer professional training according to the following table after each year of the medical program. Summer training should last 4 weeks and should focus on the professional skills development.

Scope of practices	**Number and of weeks**
Nursing	4
Primary care (family medicine)	3
Accident and Emergency	1
Internal medicine	4
Intensive care	2
Pediatrics	2
Surgery	2
Gynecology and Obstetrics	2
Total	**20**

Summer training should be carried out during the holidays. It aims to achieve the selected learning outcomes. The University verifies the professional training plan, form and timing and the manner of how the learning outcomes are accomplished.

The infrastructure necessary for the conduct of the education

The training process is conducted using the infrastructure which facilitates the achievement the learning outcomes, which should include, in particular, a prosectorium and microscopic laboratory which will enable you to conduct classes in all clinical specialties. Clinical science classes are conducted in the medical facilities. Due to their specificity and the number of health services, they provide students with the opportunity to achieve learning outcomes in clinical sciences.

Practical clinical teaching and internships should proceed within the infrastructure of the University and the infrastructure of medical facilities with which contracts or agreements have been established for this purpose, including the use of simulated clinical conditions. Practical clinical teaching and training should be conducted in medical facilities providing health services in the scope of hospital treatment, in particular in hospitals. In fact, their specificity allows to achieve the educational effects of medical facilities, medical facilities providing health services in the scope of outpatient specialist care or primary health care, outpatient care facilities, the State Medical Rescue System and Hospices.

Teachers

Training to achieve the learning outcomes during classes is provided by the academic teachers or other persons with a professional competence or scientific research and clinical experience in the field-specific studies. Clinical courses are taught by the academic staff or other persons with appropriate scientific achievements, the right to practice as a medical doctor and the title of a medical specialist in the field of medicine relevant for the classes conducted, or with sufficient clinical skills.

Tutoring

The general idea is that groups of 20-30 students should be supervised by a competent academic teacher who can provide both teaching and scientific advice, monitor the progress of the studies, tests, and assignments. One tutor should supervise the group in a continuous process throughout the course of studies (years 1-6), starting from the 1-year student leading to a fully qualified doctor. The tutor helps students develop their professional skills, social competences, ethical standards, and scientific interests. Specific tasks/project should be assigned to students and should be evaluated by a tutor.

Learning outcomes

Due to an inadequate number of learning outcomes in the Kazakh regulations (only 8 general learning outcomes listed), we attach the list of the detailed effects divided into morphological sciences, scientific principles of medicine, preclinical sciences, behavioral and social sciences with components of professionalism, non-surgical clinical sciences, clinical-surgical sciences, legal and organizational aspects of medicine. The abovementioned proposal is based on the European regulations in medical education.

The list constitutes a separate document attached to the improvement plan (Standards and Learning Outcomes for the medical studies).

The list of attached documents:

1. The Graduate profile
2. Standards and Learning Outcomes for the medical studies.
3. The proposed curriculum

Attachment 1A.1 II

The suggested modified program for the medical studies

Duration of the studies: 6 years; 12 semesters

Academic degree: medical doctor (without specialty)

1st course for the academic year 2020-2021

№	Cycle of disciplines	Name	Credit	Semester	Control
1		**Module: "Social and linguistic disiplines-1"**	**17**		
	CDOC	Modern history of Kazakhstan	5*	1	state exam
	CDOC	Kazakh/Russian language course	5*	1	exam
	CDOC	English language course	5	1,2	exam
	CDOC	Physical education	2*	1,2	grading test
2		**Module of social and political studies**	**8**		exam
	CDOC	Social, political, cultural studies	3+2*	2	
	CDOC	Psychology	3	2	
3		**Module: "Morphology"**	**14**		
	BDIC	Anatomy and embryology ½	8	1,2	exam
	BDIC	Histology and cytophysiology 1/2	6	2	exam
4		**Module: "Principles of biomedicine, information and communication technology"**	**9**		
	BDIC	Medical biophysics	6	2	exam
	CDIC	Information and communication technology	3	1	exam
5		**Module: "Molecules and cells"**	**11**		
	BDIC	Medical chemistry	3	1	exam
	BDIC	Molecular and cellular biology	6	2	exam
	BDIC	Principles of genetics	2	2	
6		**Module: "Vocational training and principles of anti-corruption awareness"**	**10**		exam

	PDIC	Vocational training ½	4	1	
	CDIC	Behavioral sciences	2	1	
	PDIC	Medical procedures	2	2	task
	PDIC	Basic elements of professionalism and communication skills (including Principles of anti-corruption awareness)	2	2	task
7	**PDIC**	**Tutoring**	1	1,2	task
8	**CDIC**	**Elective courses**	**2**	1,2	grading test
9	**PDIC**	**Summer training**	**2**	2	approval
		TOTAL	**14* + 60**		

ETCS: CDOC – 24= 14*(Kazakh obligatory component not included in the medical curriculum) + 10 (Kazakh obligatory component included in the curriculum credits) , BDIC – 31, CDIC – 7 , PDIC – 12

2nd course for the academic year2021-2022

№	**Cycle of disciplines**	**Name**	Credit	Semester	Control
1		**Module: "Social and linguistic disciplines-2"**	**17**		
	CDOC	Philosophy	3+2*	4	exam
	CDOC	Kazakh/Russian language course	5*	3	exam
	CDOC	English language course	5	3	exam
	CDOC	Physical education	2*	3,4	exam
2		**Module: "Immune response and infection"**	**9**	3,4	exam
	BDIC	General immunology	3		
	BDIC	Microbiology, virology and parasitology	6		
3		**Module: "Morphology and physiology with biochemistry"**	**22**		
	BDIC	Anatomy 2/2	5	3	exam
	BDIC	Histology 2/2	5	3	exam
	BDIC	Physiology	6	3,4	exam
	BDIC	Biochemistry	6	3,4	exam
4		**General pathology**	**10**		exam
	BDIC	Pathologic anatomy ½	5	4	
	BDIC	Pathologic physiology 1/2	5	4	
5	**BDIC**	**Medical ethics and deontology**	1	4	test

6	**BDIC**	**Principles of scientific and research methodology 1**	**1**		
7	**PDIC**	**Vocational training 2/2**	**4**	3,4	task
8	**PDIC**	**Tutoring**	**1**	3,4	task
9	**PDIC**	**Elective courses**	**2**	3,4	test
10	**PDIC**	**Summer training – first aid and general medical practice**	**2**	4	approval
		TOTAL	**60**		

ETCS: CDOC – 17=9*(Kazakh obligatory component not included in the medical curriculum) + 8 (Kazakh obligatory component included in the curriculum credits), BDIC – 43, PDIC - 9

3rd course for the academic year 2022-2023

№	Cycle of disciplines	Name	Credit	Semester	Control
1		**Module: "Pathology of organs and systems"**	**8**	5	
	BDIC	Pathologic anatomy 2/2	4		exam
	BDIC	Pathologic physiology 2/2	4		exam
2		**Module: "Propedeutics of internal and children's diseases"**	**9**	5,6	
	PDIC	Propedeutics of internal diseases 1/3	5		exam
	PDIC	Propedeutics of children's diseases 1/3	4		exam
3	BDIC	**Pharmacology**	**6**	5,6	exam
4	PDIC	**Clinical Genetics**	**4**	5,6	exam
5		**Module: "Diagnostics of diseases"**	**8**	5,6	exam
	PDIC	Clinical and laboratory diagnosis	4		
	PDIC	Visual diagnosis	4		
6		**Module: "Principles of surgery and topographic anatomy" 1/3**	**6**	5,6	
	PDIC	General surgery	4		exam
	PDIC	Topographic and radiological anatomy with operative surgery	2		exam
7	**PDIC**	**Principles of emergency medicine ½**	**2**	5,6	grading test
8		**Module: "Clinical research methodology"**	**7**	5,6	

	PDIC	Scientific management	2		exam
	PDIC	Evidentiary medicine with bioethics	2		
	BDIC	Biostatistics	3		exam
9		**Module: "Health and environment"**	**5**	5,6	
	PDIC	Public health	2		
	BDIC	Epidemiology	2		
	BDIC	Common hygiene	1		
10	PDIC	Tutoring	1	5,6	task
11	**PDIC**	**Elective courses**	**2**	5,6	grading test
12	**PDIC**	**Summer training – internal medicine**	**2**	6	approval
		TOTAL	**60**		

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4th course for the academic year 2023-2024

№	Cycle of disciplines	Name	Credit	Semester	Control
1		**Module: "Internal diseases" 2/3**	**8**		
	PDIC	Internal diseases (allergology, pulmonology, cardiology, endocrinology, gastroenterology, rheumatology, nephrology, hematology)	8	7,8	exam
2		**Module: "Children's diseases" 2/3**	**11**	7,8	
	PDIC	Children's diseases	5		exam
	PDIC	Children's infections	2		exam
	PDIC	Neonatology	1		exam
	PDIC	Pediatric surgery	3		exam
3		**Module: "Surgical diseases" 2/3**	**12**	7,8	
	PDIC	Surgical diseases	5		exam
	PDIC	Urology	2		
	PDIC	Traumatology with orthopedics	3		
	PDIC	Otolaryngology and audiology	2		
4		**Module: "Obstetrics and gynecology" 1/3**	**8**	7,8	
	PDIC	Obstetrics	5		exam
	PDIC	Gynecology with gynecologic oncology	3		
3		**Module: "Infectious diseases with dermatovenerology"**	**10**	7,8	
	PDIC	Infectious diseases	4		exam

	PDIC	Dermatovenerology	3		
	PDIC	Phthisiology	3		exam
4	PDIC	**Principles of general medical practice (family medicine) 1/3**	**3**	7,8	grading test
5	PDIC	**Principles of psychiatry 1/3**	**2**	7,8	grading test
6	PDIC	**Scientific research – research program design**	**1**	8	task
7	PDIC	**Tutoring**	**1**	8	
8	PDIC	**Elective courses**	**2**	7,8	grading test
9	PDIC	**Summer training – pediatrics and surgery**	**2**	8	approval
		TOTAL	**60**		

PDIC – 60

5th course for the academic year 2024-2025

№	Cycle of disciplines	Name	Credit	Semester	Control
1		**Module: "Diseases of the nervous system"**	**10**	**9,10**	
	PDIC	Neurology	6		exam
	PDIC	Psychiatry with narcology 2/3	4		grading test
2	PDIC	**Ophthalmology**	**4**	9,10	
3	PDIC	**Clinical immunology**	**3**	9,10	exam
4	PDIC	**Clinical pharmacology**	**3**	9,10	exam
5		**Module: "Legal regulations in medicine and communication skills"**	**5**	9,10	exam
	PDIC	Medical law	2		
	PDIC	Forensic medicine	2		
	PDIC	Communication skills in specific conditions	1		
6		**Module: "General medical practice" 2/3**	**6**	9,10	exam
	PDIC	Internal medicine in the work of general practitioner	2		
	PDIC	Children's diseases in the general practitioner's practice	2		
	PDIC	Obstetrics and gynecology in the work of a general practitioner	1		
	PDIC	Surgical diseases in the general practitioner's practice	1		
7		**Module: "Oncology and laboratory diagnostics"**	**7**	9,10	exam

	PDIC	Clinical oncology	4		
	PDIC	Visual diagnostics	1		
	PDIC	Oncological laboratory medicine	2		
8	PDIC	**Transplantology**	**2**	10	
9	PDIC	**Anesthesiology and intensive care**	**5**	9,10	exam
10	PDIC	**Geriatrics, rehabilitation and palliative care**	**3**	9,10	exam
11		**Module: "Emergency medicine 2/2"**	**5**	9,10	exam
	PDIC	Ambulance service	1		
	PDIC	Emergency medicine 2/2	4		
12	**PDIC**	**Scientific research – research program design**	**2**	**9,10**	grading test
13	**PDIC**	**Tutoring**	**1**	**9,10**	task
14	**PDIC**	**Elective course**	**2**	**9,10**	grading test
15	**PDIC**	**Summer training "Assistant of an emergency physician"**	**2**	10	approval
		TOTAL	**60**		

PDIC - 60;

Year of admission: 2020

6th course for the academic year 2020-2021 and 2025-2026

№	Cycle of disciplines	Name	Credit	Semester	Control
1		**Module: "General medical practice" 3/3**	**6**	11,12	exam
	PDIC	Integration of children management in the primary health care	2		
	PDIC	Internal medicine in the primary health care	2		
	PDIC	Mental health in the primary health care	1		
	PDIC	Emergency management in the primary health care and family planning	1		
2	**PDIC**	**Module: "Pediatrics – practical issues" 3/3**	**8**	**11,12**	
3	PDIC	**Module: "Internal medicine – practical issues" 3/3**	**16**	11,12	exam
4	PDIC	**Module: "Surgery – practical issues" 3/3**	**8**	11,12	exam
		Practical issues of general surgery	5	11,12	

		Practical issues of traumatology and neurosurgery	3	11,12	
5	PDIC	**Module: "Obstetrics and gynecology – practical issues" 2/2**	**4**	11,12	exam
6	PDIC	**Module: "Psychiatry – practical issues"3/3**	**4**	11,12	exam
7	PDIC	**Module: "Emergency medicine – practical issues" 3/3**	**4**	11,12	exam
8	PDIC	**Practical issues of the selected specialty**	**8**	12	
4		**Final State Attestation**	**3**	12	State exam
		TOTAL	**60**		

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Final State Attestation 3

Attachment 1A.1-III

The WKMOMU graduate profile

Graduate: medical doctor

Professional knowledge

1. Knows and understands the structure, mechanisms and functioning of a healthy organism
2. Knows and understands possible disorders of the structure and function of the body at the genetic, molecular, biochemical and cellular levels
3. Is familiar with diseases at the level of the individual, social and occupational groups, as well as of the population, in the scope of general practitioner's practice
4. Knows and understands the diagnosis and treatment of chronic diseases and emergencies
5. Is familiar with the technologies used for the diagnosis and treatment, both generally used and state-of-the-art, simultaneously adhering to the safety principles
6. Demonstrates the ability to ask questions and critically evaluate new, relevant information regarding the clinical and scientific issues in the course of learning
7. Demonstrates the ability to implement the acquired knowledge to solve clinical and scientific problems

Professional skills

1. Works within the limits of his / her competence, fully employing the knowledge and skills acquired
2. Knows the safety rules applicable in the workplace concerning themselves, other team members as well as patients and their relatives
3. Can transform the acquired expertise and convert it into competence for professional practice
4. Is prepared to care for patients in various environmental, social and cultural conditions
    a. in a wide range of health care centers – hospitals, primary care – clinics and doctor's offices, ambulance, intensive care units
    b. in an environment outside the health facilities – social assistance
    c. in the immediate environment of the patient – local and home-based
5. Is prepared to care for patients suffering from a number of diseases, both acute and chronic, presenting various health conditions, as well as physical and mental disorders

6. Can obtain and collect information from patients and other sources relevant to the diagnosis, treatment and prevention of frequent and urgent conditions, including the execution of the essential diagnostic procedures
7. Can interpret, analyze, evaluate and prioritize relevant data in order to establish a diagnosis and management plan, including the onset of appropriate interventions.
8. Can use the resources and achievements from other disciplines and provide an integrated patient care – multidimensionally, comprehensively, holistically (physical health – mental health – social care)
9. Takes and promotes measures to promote healthy lifestyles and health care, disease prevention at the level of the individual (patient)/social and occupational groups, as well as the entire population
10. Can evaluate, analyze and implement new knowledge related to the advances and discoveries in the biomedical sciences.
11. Can engage in scientific research to broaden the knowledge in the service of medicine.
12. Can create therapeutic relationships with patients and their families based on trust and mutual respect
13. Can communicate effectively with patients and their relatives regarding the informed consent and joint decision-making
14. Can effectively convey medical information, both orally and in writing, to other healthcare professionals, thus improving patient care.

Professional and social competence

1. Is ready to work in a team, including an interdisciplinary team – both under supervision, and as a team leader
2. Treats patients, their relatives, other doctors and healthcare professionals respectfully and politely, according to the ethical principles, with confidentiality and in accordance with applicable legal regulations
3. Can critically assess his / her knowledge and skills and distinguish the elements which require further training to ensure constant professional development.
4. Is aware of the need to continuously improve skills, broaden knowledge and practice for the consolidation and development of professional skills, as well as applies good medical practices
5. Takes responsibility for the suggested solutions, the tasks performed, and the undertaken decisions
6. Continuously follows the changes in the medical sciences and medical practice standards, is aware of the latest scientific developments, standards of therapy, diagnostic and therapeutic methods and strives to implement them in practice

7. Takes responsibility for the learning and professional development and is prepared to make a decision on the choice of a specialty – determines the direction of his / her professional and scientific path and is consistent in pursuing the abovementioned objectives
8. Is confident in his /her knowledge and skills, and is simultaneously aware of the limitations, open to constructive criticism and prepared to critically evaluate the opinions and actions of other colleagues
9. Recognizes the importance of knowledge in solving cognitive and practical problems as well as in consulting the experts in the event of difficulties in solving the problem on their own;

Attachment 1A.1 - IV

Standards and Learning Outcomes for the medical studies

Medical studies should last 6 years (12 semesters) and should be followed by a 1-year internship. The program of the studies should include at least 5700 hours of contact time (not including the Kazakh compulsory component) with the teachers, and additionally a sufficient amount of extra self-study time.

The graduate is equipped in the skills included in the graduate profile and receives the title of a medical doctor. Moreover, the graduate can start the postgraduate training in the chosen medical according to the local rules.

We do not recommend to include social and linguistic disciplines (except for English) and physical education in the number of ECTS credits required for the completion of the medical studies.

In the course of the clinical sciences education, students should have a direct access to patients, including outpatients suffering from acute and chronic diseases, appropriate to the educational content assigned to the classes or groups of classes.

The study program should allow the student to choose classes according to their interest with the assigned ECTS points of at least 3% of the number of ECTS credits required for graduation.

The list of elective courses should include issues from basic and preclinical sciences and clinical sciences with the specific learning outcomes which can be obtained.

The number of ECTS credit points, which a student can earn in terms of methods and techniques of remote learning, should not be more than 20% of the number of ECTS credits required to complete their studies.

The Kazakh compulsory component

Only selected subjects from the obligatory component were included in the medical program, as they do not match the learning outcomes of the medical studies. Issues not related to the medical program should be covered outside the curriculum, or as additional ECTS credit points.

Summer training

Summer training should be included in the program during each year of studies (4 weeks) and should consist of the development of professional skills.

Scope of training	Number of weeks
Nursing	4
Primary care (family medicine)	3
Accident and Emergency	1

Internal medicine	4
Intensive care	2
Pediatrics	2
Surgery	2
Gynecology and Obstetrics	2
Total	**20**

Summer training is performed during the holidays. It aims to achieve elected learning outcomes. The University verifies the training program, form and deadlines and how the learning outcomes are completed.

The infrastructure necessary for education

The training process is performed using the infrastructure which allows for the completion of earning outcomes which include, in particular, a prosectorium and microscopic laboratory and which will enable you to conduct classes in all clinical specialties. Clinical science classes are conducted in the medical facilities. Due to their specificity and the number of health services, they provide students with the opportunity to achieve learning outcomes in clinical sciences.

Practical clinical teaching and internships should proceed within the infrastructure of the University and the infrastructure of the medical facilities with which contracts or agreements have been established for this purpose, including the use of simulated clinical conditions. Practical clinical teaching and training should be conducted in medical facilities providing health services in the scope of hospital treatment, in particular hospitals. In fact, their specificity allows to achieve the educational effects of medical facilities, medical facilities providing health services in the scope of the outpatient specialist care or primary health care, outpatient care units, the State Emergency Medical Rescue and Hospices.

Teachers

Training to achieve learning outcomes during classes is provided by the academic teachers or other persons with a professional competence or scientific research and clinical experience in the field-specific studies. Clinical courses are taught by the academic staff or other persons with appropriate scientific achievements, the right to practice as a medical doctor and the title of a medical specialist in the field of medicine relevant for the classes conducted or with sufficient clinical skills.

Tutoring

It is a general concept that groups of 20-30 students should be supervised by a competent teacher who can provide both teaching and scientific advice, monitor the progress of the studies, tests, and assignments. One tutor should supervise the group in a continuous process for the

duration of studies (years 1-6), starting from the 1-year student leading to a fully qualified doctor. The tutor helps students develop their professional skills, social competences, ethical standards, and scientific interests. Specific tasks/projects should be assigned to students and be evaluated by a tutor.

Learning outcomes

Due to an inadequate number of learning outcomes in the Kazakh regulations (only 8 general learning outcomes listed), we attach the list of the detailed effects divided into morphological sciences, scientific principles of medicine, preclinical sciences, behavioral and social sciences with elements of professionalism, non-surgical clinical sciences, clinical-surgical sciences, legal and organizational aspects of medicine. The abovementioned proposal is based on the European regulations in medical education.

1. GENERAL LEARNING OUTCOMES

1.1. In terms of the knowledge, the graduate knows and understands:
1) the development, structure and functions of the human body both in the normal and pathological states;
2) the symptoms and the course of diseases;
3) diagnostic and therapeutic procedures relevant for the specific medical conditions;
4) the ethical, social and legal requirements to practice a medical profession and conduct health promotion and bases his / her knowledge on scientific evidence;
5) the methods of conducting scientific research.

1.2. In terms of the skills, the graduate is able to:
1) identify medical problems and prioritize medical procedures;
2) identify life-threatening conditions requiring immediate medical intervention;
3) plan the diagnostic procedure and interpret the results;
4) implement appropriate and safe therapeutic procedures and provide for their effects;
5) plan his/her own educational activity and continuously updates his/her knowledge;
6) inspire the learning process of others;
7) communicate with the patient and his/her family in an atmosphere of trust, taking into account the patient's needs and is capable of conveying unfavorable information;
8) communicate with colleagues in the team and share the knowledge;
9) critically evaluate the results of scientific research and adequately justify his/her viewpoint.

1.3. In terms of the social competence, the graduate is ready to:

1) establish and maintain deep and respectful contact with the patient, and to show understanding of the world-view and cultural differences;
2) act in the patient's interest;
3) respect medical confidentiality and patient's rights;
4) take action towards the patient on the basis of ethical principles, bearing in mind the social conditions and limitations resulting from the disease;
5) recognize one's limitations and to self-assessment deficits and educational needs;
6) promote pro-health behavior;
7) use the objective sources of information;
8) draw conclusions from his/her own calculations or observations;
9) implement the principles of professional teamwork and cooperation in a team of specialists, including representatives of other medical professions in the multicultural and multinational environment;
10) form opinions regarding various aspects of professional activity;
11) assume responsibility for the decisions made in the course of professional activities, including personal safety and the safety of others.

2. DETAILED LEARNING OUTCOMES

A. MORPHOLOGICAL SCIENCES (including anatomy, histology, embryology)

In terms of the knowledge, the graduate knows and understands:
A.K1. anatomical, histological and embryological terminology in the mother tongue and in English;
A.K2. the structure of the human body in a topographic approach (upper and lower extremities, thorax, abdomen, pelvis, back, neck, head) and functional (bone and articular system, muscular system, circulatory system, respiratory system, digestive system, urinary system, reproductive system and genitals, nervous system and the sensory organs, the integumentary system);
A.K3. the topographic relationships between various organs;
A.K4. basic cellular structures and their functional properties;
A.K5. microarchitecture of tissues, extracellular matrix and organs;
A.K6. the stages of human embryo development, the structure and function of fetal membranes and placenta, the phases of the development of various organs and the impact of the harmful factors (teratogenic) on the embryonic and fetal development.

In terms of the skills, the graduate is able to:
A.S1. operate an optical microscope, including the use of immersion;

A.S2. recognize images obtained from an optical or electronic microscope as histological structures corresponding to organs, tissues, cells and cellular elements, describe and interpret their structure and the relationship between the structures and functions;
A.S3. explain the anatomical background of the physical examination;
A.S4. make conclusion regarding the relationships between the anatomical structures on the basis of the diagnostic test results, in particular in the scope of radiology (X-rays, scan imaging with the use of a contrast agent, computed tomography, magnetic resonance imaging)
A.S5. use anatomical, histological and embryological terminology both in speech and in writing.

B. SCIENTIFIC PRINCIPLES OF MEDICINE (including biophysics, molecular biology, biochemistry with elements of chemistry, physiology with clinical physiology, cytophysiology, computer science and biostatistics).

In terms of the knowledge, the graduate knows and understands:
B.K1. water and electrolyte balance in the biological systems;
B.K2. acid-base balance and the mechanism of action of buffers and their significance in the systemic homeostasis;
B.K3. the notions of: solubility, osmotic pressure, isotonic solutions , colloidal solutions and Gibbs-Donnan equilibrium;
B.K4. basic reactions of inorganic and organic compounds in aqueous solutions;
B.K5. physical laws describing the fluid flow and the factors influencing the vascular resistance of the blood flow;
B.K6. natural and artificial sources of ionizing radiation and its interaction with the matter;
B.K7. physico-chemical and molecular principles of the sensory organ functions;
B.K8. physical principles of the non-invasive imaging methods;
B.K9. physical principles of selected therapeutic techniques, including ultrasound and irradiation;
B.K10. the structure of simple organic compounds included in the macromolecules present in cells, extracellular matrix and the bodily fluids;
B.K11. the structure of lipids and polysaccharides and their functions in cellular and extracellular compartments;
B.K12. the primary, secondary, tertiary and quaternary structure of protein, as well as post-translational and functional modifications of proteins and their significance;
B.K13. functions of nucleotides in the cell, primary and secondary structures of DNA and RNA, and the structure of chromatin;
B.K14. functions of the human genome, transcriptome and proteome and the basic methods used in studying them, processes of DNA replication, repair and recombination, as well as transcription

and translation, processes of degradation of DNA, RNA and proteins, notions of gene expression regulation;
B.K15. essential catabolic and anabolic pathways, methods of their regulation and the influence of the genetic and environmental factors on them;
B.K16. metabolic profiles of the essential (basic) organs and systems;
B.K17. methods of communication between cells and between a cell and an extracellular matrix, as well as the signaling pathways within the cell, and the examples of disorders in these processes leading to the development of cancer and other diseases;
B.K18. processes: cell cycle, proliferation, differentiation and cell ageing, apoptosis and necrosis and their significance for the functioning of the organism;
B.K19. basic issues of stem cells and their application in medicine;
B.K20. the principles of excitation and conduction in the nervous system and higher nervous function, as well as striated and smooth muscle physiology and blood functions;
B.K21. the functions and regulatory mechanisms of all organs and systems of the human body, including the circulatory system respiratory system, digestive system, urinary system and skin coatings, and the relationship between them;
B.K22. the course and regulation of the reproductive functions in women and men;
B.K23. the mechanism of the aging processes;
B.K24. basic quantitative parameters describing the performance of individual systems and organs, including ranges of norms and demographic factors affecting the values of these parameters;
B.K25. the relationship between the factors disturbing the balance of biological processes and the physiological and pathophysiological changes;
B.K26. basic IT and biostatistical tools used in medicine, including medical databases, spreadsheets and the principles of computer graphics;
B.K27. basic methods of statistical analysis used in population and diagnostic studies;
B.K28. the possibilities of modern telemedicine as a tool supporting the doctor's practice;
B.K29. the principles of conducting scientific, observational and experimental research, as well as *in vitro studies* for the development of medicine.

In terms of the skills, the graduate is able to:
B.S1. use the knowledge of the laws of physics to explain the impact of external factors, such as temperature, acceleration, pressure, electromagnetic field, and ionizing radiation, on the body and its components;
B.S2. assess the harmfulness of the ionizing radiation doses and follow the rules of radiological protection;
B.S3. calculate molar and percentage concentrations of compounds and concentrations of substances in isoosmotic, one and multi-component solutions;

B.S4. calculate the solubility of inorganic compounds, determine the chemical basis of the solubility of organic compounds or its absence, and its practical significance in terms of dietetics and therapy;
B.S5. determine the pH of the solution and the effect of pH changes on the inorganic and organic compounds;
B.S6. predict the course of biochemical processes depending on the energy status of cells;
B.S7. perform simple functional tests assessing the human body as a stable regulatory system (load tests, stress tests) and interpret the numerical data regarding basic physiological variables;
B.S8. use basic laboratory techniques, such as qualitative analysis, titration, colorimetry, pH-monitoring, chromatography, electrophoresis of proteins and nucleic acids;
B.S9. use simple measuring instruments and evaluate the accuracy of the performed measurements;
B.S10. use databases, including the internet, and search for the necessary information using available tools;
B.S11. Select an appropriate statistical test, conduct basic statistical analyzes, use proper methods of presenting the results, interpret the results of a meta-analysis and perform the survival probability analysis;
B.S12. explain the differences between prospective and retrospective studies, randomized and case-control studies, case reports and experimental studies and rank them according to the reliability and quality of the scientific evidence;
B.S13. plan and carry out simple scientific research and interpret their results, as well as draw conclusions.

C. PRE-CLINICAL SCIENCES (including genetics, microbiology, immunology, pathology, pharmacology with toxicology, elements of pathophysiology)
In terms of the knowledge, the graduate knows and understands:
C.K1. basic notions of genetics;
C.K2. the phenomena of gene coupling and interaction;
C.K3. normal human karyotype and various types of gender determination;
C.K4. structure of chromosomes and the molecular basis of mutagenesis;
C.K5. the principles of inheritance of various numbers of traits, inheritance of quantitative traits, independent traits, as well as inheritance of non-nuclear genetic information;
C.K6. genetic determinants of the human blood groups and serological conflict in the Rh system;
C.K7. autosomal and heterosomal aberrations resulting in diseases, including oncogenesis and cancer;
C.K8. factors influencing the primary and secondary genetic balance of the population;
C.K9. the principles regarding the diagnosis of gene and chromosomal mutations responsible for hereditary and acquired diseases, including cancer;

C.K10. the benefits and risks of the presence of genetically modified (GMOs) in the ecosystem;
C.K11. genetic mechanisms of acquiring drug resistance by microorganisms and malignant cells;
C.K12. microorganisms, including the pathogenic and physiological flora;
C.K13. epidemiology of viral and bacterial infections, as well as fungal and parasitic infections, including their geographical distribution;
C.K14. the influence of abiotic and biotic (viruses, bacteria) environmental factors on the human body and the human population and the way they enter the human body;
C.K15. the consequences of exposure of the human body to various chemical and biological agents and phenomena, as well as the rules of prevention;
C.K16. invasive forms or developmental stages of selected parasitic fungi, protozoa, helminths and arthropods, taking into consideration their geographical distribution;
C.K17. operating principle of the parasite-host system and the basic disease symptoms caused by parasites;
C.K18. the symptoms of iatrogenic infections, the route of pathogen spreading and the pathogens inducing changes in various organs;
C.K19. the principles of microbiological and parasitological diagnostics;
C.K20. the principles of disinfection, sterilization and aseptic procedures;
C.K21. the principles of development and mechanisms of the immune system activity, including specific and non-specific mechanisms of humoral and cellular immunity;
C.K22. the major histocompatibility complex;
C.K23. types of hypersensitivity reactions, types of immunodeficiency, as well as the principles of immunomodulation;
C.K24. issues of cancer immunology;
C.K25. genetic basis for donor and recipient selection, and the principles of transplant immunology;
C.K26. pathomorphological terminology;
C.K27. basic mechanisms of cell and tissue damage;
C.K28. the clinical course of specific and non-specific inflammations, and the regeneration processes of tissues and organs;
C.K29. definition and pathophysiology of shock, with particular of emphasis on the differentiation between the causes of shock and multi-organ failure;
C.K30. the etiology of hemodynamic disorders, retrograde changes and progressive changes;
C.K31. issues of detailed pathology of organs, macro- and the microscopic images and the clinical course of pathomorphological changes in particular organs;
C.K32. consequences of developing pathological changes for anatomically adjacent organs;
C.K33. external and internal pathogens, both modifiable and non-modifiable;
C.K34. clinical forms of the most common diseases of various systems and organs, metabolic and hormonal diseases, water-electrolyte and acid-base balance disorders;

C.K35. different groups of therapeutic agents;
C.K36. main mechanisms of a drug action and its metabolism in the human body depending on age;
C.K37. the impact of disease on drug metabolism and its elimination;
C.K38. basic principles of pharmacotherapy;
C.K39. essential side effects of drugs, including those resulting from their interaction;
C.K40. drug resistance problem, including multi-drug resistance;
C.K41. indications for genetic testing performed in order to personalize pharmacotherapy;
C.K42. directions of therapy development, in particular the possibilities of cell, gene and targeted therapy in specific diseases;
C.K43. basic notions of general toxicology;
C.K44. groups of drugs, the abuse of which may lead to poisoning;
C.K45. symptoms of most common acute poisoning, including alcohol, drugs and other psychoactive substances, heavy metals and selected groups of medications;
C.K46. basic principles of diagnostic procedures in poisoning;
C.K47. the influence of oxidative stress on cells and its significance in the pathogenesis of diseases and in the ageing process;
C.K48. the consequences of deficiency and excess of vitamin or minerals in the body;
C.K49. enzymes involved in digestion, the mechanism of hydrochloric acid production in the stomach, the role of bile, the mechanism of absorption of digestive products;
C.K50. the consequences of improper nutrition, including prolonged starvation, excessive eating and the use of an unbalanced diet, and disorders regarding the digestion and absorption of digestive products;
C.K51. the mechanisms of hormone action.

In terms of the skills, the graduate is able to:
C.S1. analyze genetic crosses and pedigrees of human traits and diseases, as well as assess the risk of having a child with chromosomal aberrations;
C.S2. identify indications for prenatal testing;
C.S3. make decisions concerning the need to perform cytogenetic and molecular tests;
C.S4. perform morphometric measurements, analyze the morphogram and record karyotypes of diseases;
C.S5. estimate the risk of a given disease in the offspring on the basis of the family predispositions and environmental factors impact;
C.S6. assess environmental risks and use basic methods to detect the presence of harmful factors (biological and chemical) in the biosphere;
C.S7. recognize the most common human parasites on the basis of their structure, life cycles and disease symptoms;

C.S8. use the antigen–antibody reaction in current modifications and techniques for the diagnosis of infectious, allergic, autoimmune and neoplastic diseases, and blood diseases;
C.S9. prepare slides and recognize pathogens under a microscope;
C.S10. interpret the results of microbiological tests;
C.S11. associate the images of tissue and organ damage with clinical symptoms of a disease, the patient's history and results of laboratory tests;
C.S12. analyze reactive, defensive and adaptive phenomena, as well as dysregulations triggered by etiological factors;
C.S13. perform simple pharmacokinetic calculations;
C.S14. select drugs in appropriate doses in order to prevent pathological phenomena in the body and in individual organs;
C.S15. design schemes of rational chemotherapy of infections, both empirical and targeted;
C.S16. prepare records of all prescription forms of medicinal substances;
C.S17. use pharmaceutical guides and databases on medicinal products;
C.S18. estimate the toxicological hazard in the specific age groups and in liver and kidney failure, as well as prevent drug poisoning;
C.S19. interpret the results of toxicological investigations;
C.S20. describe changes in the functioning of the body in case of homeostasis disorders, and in particular define its integrated response to physical exertion, exposure to high and low temperatures, loss of blood or other bodily fluids, sudden upright position, and the transition from sleep to wakefulness.

D. BEHAVIORAL AND SOCIAL SCIENCES WITH ELEMENTS OF PROFESSIONALISM (including medical sociology, medical psychology, medical ethics, history of medicine, elements of professionalism, English language)
In terms of the knowledge, the graduate knows and understands:
D.K1. the social dimension of health and disease, the impact of the social environment (family, social relations) and social inequalities, and socio-cultural differences on health, as well as the role of social stress in health and self-destructive behavior;
D.K2. social factors affecting health and disease behavior, in particular in chronic disease;
D.K3. forms of violence, models explaining domestic violence and violence in selected institutions, social determinants of various forms of violence and the role of doctor in recognizing it;
D.K4. social attitudes towards the significance of health, disease, disability and old age, social consequences of disease and disability, and socio-cultural barriers, as well as the notion of health-related quality of life;
D.K5. principles and methods of communication with the patient and his family, that help build an empathetic, trust-based relationship;

D.K6. the significance of the verbal and non-verbal communication in the process of communicating with a patient, and the notion of trust in the interaction with a patient;
D.K7. psychosocial consequences of hospitalization and chronic disease;
D.K8. functioning of the healthcare system facilities and the social role of the doctor;
D.K9. basic psychological mechanisms of human functioning in health and in disease;
D.K10. the role of the patient's family in the treatment process;
D.K11. the stages of adapting the patient and his family to the disease as a difficult situation and to the related events, including the process of dying and family mourning;
D.K12. the role of stress in the etiopathogenesis and in the course of diseases, as well as the mechanisms of coping with stress;
D.K13. mechanisms, objectives and methods of treating addiction to psychoactive substances;
D.K14. principles of health promotion, tasks and main lines of action associated with it, with particular emphasis on the role of a healthy lifestyle;
D.K15. principles of motivating the patient to pro-health behaviors and informing about an unfavorable prognosis;
D.K16. main notions, theories, ethical principles providing a general framework for the proper interpretation and analysis of moral and medical issues;
D.K17. patient's rights;
D.K18. team work rules;
D.K19. cultural, ethnic and national conditioning of human behavior;
D.K20. the history of medicine, the medicine of primitive peoples and the most ancient civilizations, with the characteristic features of medicine in the Middle Ages;
D.K21. features of modern medicine and its most crucial discoveries;
D.K22. the process of developing new specialties in the field of a scientific discipline – medical sciences and achievements of the leading representatives of both national and global medicine;
D.K23. fundamentals of the evidence-based medicine.

In terms of the skills, the graduate is able to:
D.S1. take into account the patient’s subjective needs and expectations resulting from the socio-cultural conditions in the process of therapeutic treatment;
D.S2. recognize the signs of anti-health and self-destructive behaviors and respond accordingly;
D.S3. choose the type of treatment, which minimizes the social consequences for the patient;
D.S4. establish the atmosphere of trust throughout the process of diagnosis and treatment
D.S5. conduct a conversation with an adult patient and child, and family, using the technique of active listening and expressing empathy, and talk to the patient concerning his life situation;
D.S6. inform the patient about the purpose, course and possible risk factors of the recommended diagnostic or therapeutic actions, and obtain his/her informed consent for such measures;
D.S7. involve the patient in the therapeutic process;

D.S8. provide the patient and his family with information regarding unfavorable prognosis;
D.S9. provide advice concerning compliance with therapeutic recommendations and a healthy lifestyle;
D.S10. identify risk factors for violence, recognize violence and react accordingly;
D.S11. use elementary psychological motivation and supportive interventions;
D.S12. communicate with colleagues by providing feedback and support;
D.S13. follow ethical standards in professional activities;
D.S14. recognize the ethical implications of medical decisions and distinguish between factual and normative aspects;
D.S15. respect patient's rights;
D.S16. present responsibility for improving his qualifications and transferring knowledge to others;
D.S17. critically analyze medical literature, including English, and draw conclusions;
D.S18. communicate with the patient in one of the foreign languages at B2+ level according to the Common European Framework of Reference for Languages (CEFR).

E. NON-surgical CLINICAL SCIENCES (including pediatrics, internal medicine, neurology, geriatrics, psychiatry, dermatology, oncology, family medicine, rehabilitation, laboratory diagnostics, clinical pharmacology)
In terms of the knowledge, the graduate knows and understands:
E.K1. environmental and epidemiological conditions of the most common diseases;
E.K2. the principles of nutrition for healthy and sick children, including breastfeeding, vaccination and keeping the records of the child's health;
E.K3. causes, symptoms, diagnostic and therapeutic procedures for the most common diseases of children:

1) rickets, tetanus, convulsions,
2) heart defects, myocarditis, endocarditis and pericardium, cardiomyopathy, arrhythmias, heart failure, hypertension, fainting,
3) acute and chronic diseases of the upper and lower respiratory tract, congenital respiratory tract, tuberculosis, cystic fibrosis, asthma, allergic rhinitis, hives, anaphylactic shock, vascular edema,
4) anemia, hemorrhagic blemishes, bone marrow insufficiency, childhood cancers, including age-specific solid tumors in children,
5) acute and chronic abdominal pain, vomiting, diarrhea, constipation, bleeding from the digestive tract, ulcer, non-specific intestinal diseases, diseases of the pancreas, cholestasis, liver diseases and other acquired diseases, as well as congenital diseases in the gastrointestinal tract,

6) urinary tract infections, urinary tract congenital disorders, nephrotic syndrome, kidney stones, acute and chronic renal failure, acute and chronic renal inflammation, systemic kidney diseases, bladder-ureteral reflux disease,

7) growth disorders, thyroid and adrenal diseases, adrenal diseases, diabetes, obesity, puberty disorders and gonad function,

8) cerebral palsy, encephalomyelitis and meningitis, epilepsy,

9) most common infectious diseases of childhood,

10) genetic syndromes,

11) connective tissue diseases, rheumatic fever, juvenile arthritis, systemic lupus, dermatitis;

E.K4. The issue of maltreated children and sexual exploitation, mental disorders and behavioral disorders – psychosis, addiction, eating disorders, excretion in children;

E.K5. Basic methods of the diagnosis and therapy of the fetus;

E.K6. The most common life-threatening conditions in children and management of these states;

E.K7. Causes, symptoms, diagnostic and therapeutic procedures concerning the most common internal diseases occurring in adults and their complications:

1) cardiovascular diseases, including ischemic heart disease, heart defects, endocardium, heart muscle, pericardium, heart failure (acute and chronic), arterial and venous vascular diseases, hypertension – primary and secondary hypertension, pulmonary hypertension,

2) respiratory diseases, including respiratory diseases, chronic obstructive pulmonary disease, bronchial asthma, bronchial dilation, cystic fibrosis, respiratory infections, interstitial lung diseases, pleural, mediastinal, obstructive and central sleep apnea, respiratory distress (acute and chronic), neoplasms of the respiratory system

3) diseases of the digestive system, including diseases of the mouth, esophagus, stomach and duodenum, intestines, pancreas, liver, bile ducts and gall bladder

4) diseases of the endocrine system, including diseases of the hypothalamus and pituitary gland, thyroid gland, pituitary gland, cortex and adrenal cord, ovaries and testicles, neuro-endocrine tumors, multi-morbidity syndromes, different types of diabetes mellitus and the metabolic syndromes – hypoglycemia, obesity, dyslipidemia,

5) diseases of the kidneys and urinary tract, including acute and chronic kidney disease, renal glomerular and interstitial kidney disease, kidney cysts, kidney stones, urinary tract infections, cancers of the immune system, urinary tract, in particular the bladder and kidneys,

6) diseases of the hematopoietic system, including bone marrow aplasia, anemia, granulocytopenia and agranulocytosis, acute leukemia, myeloproliferative and myelodysplastic tumors; myeloproliferative, myelodysplastic disorders, neoplasms from mature B and T lymphocytes, hemorrhagic blemishes, thrombophilia, life-threatening states in hematology, blood disorders in diseases of other organs,

7) rheumatic diseases, including connective tissue systemic diseases, systemic vasculitis, arthritis with spinal seizure, metabolic disorders, osteoporosis and osteoarthritis, gout

8) allergic diseases including anaphylaxis and anaphylactic shock, edema, angioedema,

9) water-electrolyte and acid-base disorders: states of dehydration, electrolyte disturbances, acidosis

E.K8. The course and symptoms of the ageing process and the principles of overall geriatric evaluation, interdisciplinary care in the elderly;

E.K9. The causes and basic differences in the most common diseases occurring in the elderly and the rules of conduct in geriatric patients;

E.K10. Basic principles of pharmacotherapy of diseases of the elderly;

E.K11. The risks associated with the hospitalization of the elderly;

E.K12. Basic principles concerning organizing the care of the elderly and the burden on the caregiver of an older person;

E.K13. Primary symptoms of neurological syndromes;

E.K14. Causes, symptoms, diagnostic and therapeutic procedures in the most common diseases of the nervous system, including:

1) headaches: migraine, tension headache and headache syndromes, as well as neuralgia of the trigeminal nerve,

2) vascular diseases of the brain, in particular a stroke,

3) epilepsy,

4) infections of the nervous system, in particular meningitis and encephalomyelitis, Lyme disease, herpes encephalitis, neurotransmission,

5) dementia, in particular Alzheimer's disease, frontal dementia, vascular dementia and other dementia syndromes,

6) diseases of the basal ganglia, in particular Parkinson's disease,

7) demyelinating diseases, in particular multiple sclerosis,

8) diseases of the neuromuscular system, in particular amyotrophic lateral sclerosis,

9) hemorrhage and cerebral injuries, in particular, concussion;

E.K15. Basic notions in the pathogenesis of mental disorders;

E.WK16. General symptomatology of mental disorders and the rules for their classification according to the diagnostic and statistic manual of mental disorders (DSM) and international classification of diseases (ICD);

E.K17. Symptoms, diagnostic and therapeutic procedures in the most common mental disorders, including:

1) schizophrenia,

2) affective disorders,

3) neurotic and adaptive disorders,

4) eating disorders,

5) disorders associated with the intake of psychoactive substances,
6) sleep disorders;

E.K18. The principles of the diagnosis and emergency treatment in psychiatry, including suicide;

E.K19. The specificity of mental disorders and their treatment in children, adolescents and in the elderly;

E.K20. Symptoms, consequences and prognosis of mental disorders in the course of somatic diseases, the rules of their treatment;

E.K21. The issue of human sexuality and the associated underlying disorders;

E.K22. Provisions on the protection of mental health, with particular regard to the rules for admission to a psychiatric hospital;

E.K23. Environmental and epidemiological conditions of the most common cancers;

E.K24. The basic principles of early cancer detection and screening in oncology;

E.K25. Possibilities for modern cancer therapy, including therapies: multimodal therapy, cell and gene therapy and their adverse effects;

E.W26. Principles of combination therapies in oncology, diagnostic and treatment algorithms in the most common cancers;

E.W27. Principles of the diagnosis and treatment in the most common problems of palliative medicine, including:

1) symptomatic treatment of the most common somatic symptoms,
2) the treatment of cancer wasting and the prevention and treatment of pressure ulcers
3) the most common emergencies in palliative medicine;

E.K28. Rules of palliative conduct with the patient in the terminal state;

E.K29. Rules for the treatment of pain, including cancer and chronic pain;

E.K30. The notions of disability;

E.K31. The role of medical rehabilitation and the methods used;

E.K32. The fundamental issues of prevention and the principles of dealing with occupational exposure to dangerous and harmful agents;

E.K33. Rules of conduct in detection of an infectious disease;

E.K34. Triggering factors, symptoms, diagnostic and therapeutic procedures, and the prevention of the most common bacterial, viral, parasitic infections, including pneumococcal infections, viral hepatitis, tuberculosis, and acquired immunodeficiency syndrome (AIDS), sepsis and nosocomial infections;

E.K35. Characteristics, environmental and epidemiological conditions of the most common skin diseases;

E.K36. Causes, symptoms, diagnostic and therapeutic procedures in the most common sexually transmitted diseases;

E.K37. Causes, symptoms, diagnostic and therapeutic procedures in the most common hereditary diseases;

E.K38. Causes, symptoms, diagnostic and therapeutic procedures in the most common diseases and specific challenges in the family doctor's practice;
E.K39. Types of biological materials used in laboratory diagnosis and rules for the collection of testing samples;
E.K40. Theoretical and practical basis for laboratory diagnostics;
E.K41. The possibility and limitations of laboratory tests in emergencies;
E.K42. Indications for the implementation of monitored therapy;
E.K43. Basic pharmaco-economic notions.

In terms of the skills, the graduate can:
E.S1. Take medical history of an adult patient;
E.S2. Take a medical history of the child and his/her family;
E.S3. Perform a full and targeted physical examination of the adult patient;
E.S4. Perform a physical examination of a child of any age;
E.S5. Perform a psychiatric examination;
E.S6. Perform an indicative hearing and visual field examination and otoscopy;
E.S7. Assess the general condition, state of consciousness and consciousness of the patient;
E.S8. Assess the condition of a newborn according to the Apgar score and its maturity and examine the neonate;
E.S9. Anthropometric and blood pressure measurements with data on the centile chart;
E.S10. Assess the stage of sexual puberty;
E.S11. Perform health evaluation tests;
E.S12. Perform differential diagnosis of the most common diseases of adults and children;
E.S13. Assess and describe the patient somatic and mental state;
E.S14. Recognize states of immediate life emergency;
E.S15. Recognize the condition after ingestion of alcohol, drugs and other stimulants;
E.S16. Plan diagnostic, therapeutic and prophylactic procedures;
E.S17. Analyze the possible side effects of individual medicines and their interactions;
E.S18. Recommend the individualization of existing therapeutic guidelines and other treatment in the circumstances of ineffectiveness or contraindications to the standard therapy;
E.S19. Recognize the symptoms of drug-dependency and recommend treatment procedures;
E.S20. Qualify the patient for home and hospital treatment;
E.S21. Recognize conditions in which the duration of life, functional condition or patient's preferences limit the treatment following the guidelines set out for the particular disease;
E.S22. Perform a functional assessment of the patient with disabilities;
E.S23. Recommend a rehabilitation program in the most common diseases;
E.S24. Interpret the results of laboratory tests and identify the reasons for their exceeding the reference range;

E.S25. Use nutritional treatment, including enteral and parenteral nutrition;
E.S26. Plan to proceed in the event of exposure to a blood-borne infection;
E.S27. Qualify the patient for the vaccination;
E.S28. Collect and secure the test material used in the laboratory diagnosis;
E.S29. Perform the necessary medical procedures and treatments, including:

1) measurement of body temperature (superficial and deep), heart rate measurement, non-invasive blood pressure measurement,
2) monitoring of vital signs using a cardio monitor and pulse oximetry,
3) spirometry, oxygen treatment, assisted and replacement ventilation,
4) introduction of the oral-pharyngeal tube,
5) intravenous, intramuscular and subcutaneous injections, cannulation of peripheral veins, peripheral venous blood collection, blood collection for cultures, arterial blood collection,
6) collecting swabs from the nasal cavity, oral cavity and the skin,
7) bladder catheterization in men and women, gastric lavage, enema,
8) standard resting electrocardiogram with interpretation, cardioversion and heart defibrillation,
9) simple strip tests and blood glucose measurement;

E.S30. Assist in performing the following medical procedures:

1) blood and blood products transfusion,
2) pleural cavity drainage,
3) pericardial sling puncture,
4) peritoneal cavity puncture,
5) lumbar puncture,
6) fine needle biopsy,
7) epidermal tests,
8) intradermal and codification tests and interpret their results;

E.S31. Interpret the pharmaceutical characteristics of medicinal products and critically evaluate advertising materials for medicines;
E.S32. Plan necessary specialist consultations;
E.S33. Implement the necessary treatment procedure in acute poisoning;
E.S34. Monitor the condition of the patient poisoned with chemicals or drugs;
E.S35. Assess the appliance and use appropriate dressings;
E.S36. Manage the injury (provide a dressing or immobilization, supply and secure the wound);
E.S37. Recognize the end of the patient’s agony and determine his / her death;
E.S38. Keep the patient's medical records.

F. SURGICAL CLINICAL SCIENCES (including anesthesiology and intensive care, general surgery, orthopedic with traumatology, emergency medicine, oncological surgery, gynecology and obstetrics, urology, otorhinolaryngology, ophthalmology, neurosurgery, transplantation, radiology)

In terms of the knowledge, the graduate knows and understands:

F.K1. Causes, symptoms, diagnostic and therapeutic procedures of the most common diseases requiring surgical intervention, comprising children, including in particular:

1) acute and chronic diseases of the abdominal cavity,
2) diseases of the thorax,
3) diseases of the extremities and head,
4) bone fractures and organ injuries;

F.K2. Selected issues of pediatric surgery, including traumatology otorhinolaryngology, and the defects and acquired diseases which are an indication for the surgical treatment in children;

F.K3. Eligibility rules for necessary surgical and invasive procedures diagnostic and curative methods, the rules for their execution and the most common complications;

F.K4. Perioperative safety rules, patient preparation for surgery, performing general and local anesthesia and controlled sedation;

F.K5. Postoperative treatment with analgesic therapy and postoperative monitoring;

F.K6. Indications and rules for the use of intensive care;

F.K7. Guidelines for cardiopulmonary resuscitation of newborns, children and adults;

F.K8. Principles for the functioning of the integrated state emergency system;

F.K9. The reproductive function of the woman, the disorders associated with them and the conduct of diagnostic and therapeutic measures relating in particular to:

1) the menstrual cycle and its disorders,
2) pregnancy,
3) physiological and pathological childbirth and post-partum period,
4) genital inflammatory and neoplastic diseases,
5) birth control,
6) menopause,
7) basic gynecological diagnostic methods and procedures;

F.K10. Contemporary imaging examinations, in particular:

1) radiological symptomatology of the underlying diseases,
2) instrumental methods and imaging techniques used to perform medical procedures,
3) indications, contraindications and preparation of the patient for individual types of imaging studies and contraindications regarding the use of the contrast agents;

F.K11. Issues relating to diseases of the organs of vision, in particular:

1) causes, symptoms, diagnostic principles and therapeutic procedures in the most common eye diseases,

2) eye complications of the systemic diseases together with their symptomatology and the rule of management,

3) surgical procedures in individual eye diseases,

4) the main groups of medicines used for ophthalmology, their side effects and interactions,

5) groups of medicines used generally, with their complications and ophthalmic contraindications, as well as their mechanism of action;

F.K12. Issues of laryngology, phoniatry and audiology, including:

1) causes, clinical course, methods of treatment, complications and prognosis in the diseases of the ear, nasal cavity, paranasal sinuses, mouth, pharynx and larynx,

2) diseases of the facial nerve and the selected structures of the neck,

3) diagnostic procedures and management in the mechanical injuries of the ear, nasal cavity, larynx and esophagus,

4) diagnostic procedures and management of emergencies in the otorhinolaryngology, in particular in the laryngeal dyspnea,

5) diagnostic procedures and management in hearing, voice and speech impairments,

6) diagnostic procedures and management in tumors of the head and neck;

F.K13. Causes, symptoms, diagnostic and therapeutic procedures for the most common diseases of the central nervous system, such as:

1) the brain edema and its consequences, in particular in the emergency issues

2) other forms of intracranial pressure and their consequences,

3) skull-brain injuries,

4) vascular defects of the central nervous system,

5) tumors of the central nervous system,

6) diseases of the vertebral column and the spinal cord;

F.K14. Principles of transplantation, indications for transplantation of the irreparably damaged organs and tissues, as well as the related procedures;

F.K15. The protocol of a suspected and diagnosed brain death;

F.K16. The algorithm for individual stages of accidental hypothermia and post-traumatic hypothermia.

In terms of the skills, the graduate can:

F.S1. Assist with a typical surgery, prepare an operating field and locally anesthetize the operated area;

F.S2. Use essential surgical instruments;

F.S3. Comply with aseptic and antiseptic principles;

F.S4. Dress a superficial wound, apply and change a sterile surgical dressing;

F.S5. Perform a peripheral puncture;

F.S6. Examine breasts, lymph nodes, thyroid gland and the abdominal cavity for acute abdomen and perform a digital rectal examination;
F.S7. Evaluate the radiological examination for the most common types of fractures, including long bone fractures;
F.S8. Perform emergency immobilization of an extremity, choose the required type of immobilization in typical clinical situations, and to control the proper extremity blood supply after implementation of the immobilizing dressing;
F.S9. Control external bleeding;
F.S10. Perform basic life support using an automatic external defibrillator and other rescue operations, as well as provide the first aid;
F.S11. Operate according to the algorithm of the advanced life support;
F.S12. Monitor the patient's condition in the postoperative period according to the basic vital signs;
F.S13. Identify the signs and symptoms indicating abnormalities of pregnancy (abnormal bleeding, contraction of the uterus);
F.S14. Interpret the results of a physical examination of a pregnant woman (blood pressure, maternal and fetal hearts), as well as the laboratory results in the case of a pathological pregnancy;
F.S15. Interpret the cardiotocography (KTG) examination;
F.S16. Recognize the onset of childbirth and its abnormal duration;
F.U17. Interpret signs and symptoms during post-pregnancy;
F.U18. Make recommendations, indications and contraindications to the use of contraception;
F.U19. Perform ophthalmic screening;
F.U20. Recognize ophthalmic conditions requiring immediate help and provide initial, qualified assistance in cases of injury physical and chemical conditions of the eye;
F.U21. Assess the condition of an unconscious patient following international rating scales;
F.U22. Recognize the symptoms of an increasing intracranial pressure;
F.U23. Assess the indications for the performance of the suprapubic puncture and participate in it;
F.U24. Assist with typical urological procedures (diagnostic and therapeutic endoscopy of the urinary system, lithotripsy, prostate puncture);
F.U25. Perform the essential ENT examinations in the ear, nasal cavity, pharynx and larynx;
F.U26. Perform an indicative hearing test.

G. LEGAL AND ORGANIZATIONAL ASPECTS OF MEDICINE (including hygiene, epidemiology, public health, medical law, forensic medicine)
In terms of the knowledge, the graduate knows and understands:

G.K1. The methods for assessing the health of the individual as well as of the population, different disease classification systems and medical procedures;
G.K2. Ways of identifying and investigating risk factors, disadvantages and advantages of different types of epidemiological conditions and measures demonstrating a cause-and-effect relationship
G.K3. Epidemiology of infectious and chronic diseases, prevention at different stages of the natural course of the disease and the role of epidemiological factors;
G.K4. The notions and objectives of public health, tasks, the structure and organization of the health protection at the national and global level, the impact of the health opportunities;
G.K5. Regulations on the provision of health services, patient's rights, labor law, the fundamentals of the medical doctor profession, as well as the functioning of a medical office;
G.K6. Basic legal regulations on the organization and financing of the health care system, health insurance, universal health insurance and the principles of organizing medical entities;
G.K7. Legal obligations of a medical doctor concerning the determination of death;
G.K8. Regulations and basic methods of a medical experiment, and other medical research, including the basic techniques of data analysis;
G.K9. Regulations on transplantation, artificial procreation, termination of pregnancy, esthetic procedures, palliative treatment, mental illness;
G.K10. Basic pharmaceutical law regulations;
G.K11. Legal regulations regarding medical confidentiality, record-keeping and criminal, civil and professional liability of the doctor;
G.K12. The notion of violent death and sudden death, as well as the differences between a trauma and an injury;
G.K13. Legal foundations and medical doctor's rules of on-site examination, autopsy and forensic autopsy of the deceased;
G.K14. Principles of forensic diagnostics and opinions in the cases of infanticide and reconstruction of circumstances of road accident;
G.K15. The principles of preparing opinions as experts in criminal matters;
G.K16. The rules of medico-legal opinion regarding fitness to stand trial, biological effect and damage to health;
G.K17. The notion of a medical error, the most common causes of medical errors and the opinion in such cases;
G.K18. The principles of materials collection for toxicological and genetic tests.

In terms of the skills, the graduate can:
G.S1. Demographic structure of the population and, on this basis, assess the problems of population health;
G.S2. Collect information on the risk factors for infectious diseases and chronic diseases, and plan preventive measures at different levels of prevention;

G.S3. Interpret measures of the prevalence of diseases and disabilities;
G.S4. Assess the epidemiological situation of the common diseases in Kazakhstan and in the world;
G.S5. Explain to individuals receiving medical services their fundamental rights and legal bases for providing the abovementioned services;
G.S6. Prepare medical certificates for patients, their families and other stakeholders;
G.S7. Recognize a child's behavior and symptoms in the course of examination for possible child abuse;
G.S8. Act in a manner to avoid medical errors;
G.S9. Collect blood for toxicological testing and securing the test material for genetic effects.

3. HOW TO VERIFY THE ACHIEVED LEARNING OUTCOMES

1. To ensure the full implementation of the curriculum, a detailed matrix of learning outcomes should be prepared.
2. Learning outcomes and their appropriate symbols as well as the verification method should be included in the syllabi.
3. The verification of the achieved learning outcomes requires different validation forms relevant for the categories of the knowledge, skills and competencies associated with these effects.
4. The learning outcomes achieved in the knowledge category can be verified by means of written or oral examinations.
5. Essays, reports, short essays, short examinations can be used as forms of written examinations. Structured questions, *multiple*-choice questions (MCQ), *Multiple Response Questions* (MRQ), Yes/No tests, or a matching response tests.
6. The examinations should be standardized and designed to test the knowledge at a higher level than the subject knowledge (level of understanding of analysis and synthesis of information and problem solving).
7. The verification of the learning outcomes achieved in the skills category regarding communication and procedural (manual) communication requires direct observation of the student, demonstrating a given skill in the course a regular clinical examination, or a standardized examination *(Objective Structured Clinical Examination (*OSCE) and *Mini-Cex*. The OSCE examination is indicated, in particular, as a form to check all the clinical skills acquired in the course of the practical teaching during the 6th year of study.

Attachment 1A2 – I

A report with the suggested changes in the academic staff management policy and procedures

A. Types of posts and working time

1. If the WKMOMU authorities are interested in the development of the research activities, the following types of posts, with a precisely defined scope of duties, should be introduced
    a. research and teaching staff (reducing the current number of teaching hours by 50%) – about 25% of all the employed persons
    b. teaching staff (keeping the current number of teaching hours) – no obligation to conduct scientific research – about 65% of all the employed persons
    c. research and technical staff (no teaching obligation) involved in the laboratory work – about 10% of all the employed persons
2. It is required to clearly define the maximum limit of overtime (additionally payable) related to teaching work
    a. research and teaching staff – a maximum increase in the number of teaching hours in relation to the contractual teaching load by 50%
    b. teaching staff – maximum increase in the number of teaching hours in relation to the contractual teaching load by 100%
3. The rate for the accrued overtime should depend on the post held.
4. It is required to clearly define the maximum reduction in the contractual teaching load stemming from:
    a. holding a function at the University
    b. outstanding research activity (at this point, the criteria for such an activity should be additionally defined)
5. It is vital to clearly define the number of students forming each group selected during the studies (the number of students per one teacher).
    a. lectures – classes delivered to the entire group of students at a given academic year – at least 50% of lectures should be delivered on-line, or in the form of e-learning
    b. seminars – classes delivered to a single dean's group (this group should include 24 students) – at least 30% of lectures should be delivered on-line, or in the form of e-learning

c. contact classes in the scope of basic and pre-clinical sciences – groups of 12 people – at least 25% of such classes should be delivered on-line, or in the form of e-learning
d. contact classes in the scope of non-surgical clinical sciences – groups of 8 people
e. contact classes in the scope of non-surgical clinical sciences – groups of 6 people
f. supervision over the students' work – introducing the function of a tutor, i.e., an educator supporting one group of students from the first to the last year of the studies

6. All the abovementioned information should be published on the University website.

B. Recruitment, development path and a periodic evaluation of staff members

1. In the process of recruiting employees, it is required to clearly define the minimum criteria for employment in a given post (preferably in the form of points)
    a. it is required to specify which research achievements a person undertaking work in a research and teaching post should have; in the case of the first employment, such a person should be the author/co-author of at least one research paper published in a peer-reviewed scientific journal
    b. in the case of the first employment of the teaching staff, such requirement should be represented by the average of grades obtained during their studies; such an average should be higher than the median (or be in the first or second quartile) of all averages obtained at a given university over the last 5 years
2. In the case of research and teaching staff, a newly recruited person should be employed following a competition.
3. Each and every person recruiting for a given post (regardless of the result) should obtain information from the recruitment committee regarding their "strengths" and "weaknesses", as well as find out how many points in a given procedure they have obtained.
4. Each and every member of the research and teaching, as well as teaching staff should define their development path (a prospect of academic promotion and promotion related to the post held, along with a specified time frame). This path should also comprise a list of possible training courses, workshops and internships financed (by means of internal competitions) by the WKMOMU
5. The aforementioned development path should be related to the schedule and criteria of a periodic evaluation.
6. The periodic evaluation should:
    a. concern both research and teaching, as well as teaching staff
    b. be open to the employee under evaluation and their immediate supervisor

c. be comprehensive - depending on the post held, it should take into account the opinion of the immediate supervisor and students
d. be precisely defined and contain the minimum expectations for the research and teaching and teaching staff; in the case of the first group of employees, this evaluation should take into account the number and quality of the published research papers, obtained patents and awarded grants, active participation in foreign conferences, as well as properly parameterised expectations with regard to teaching; in the case of teaching staff members, the periodic evaluation should solely concern the teaching activities; the periodic evaluation of research and teaching and teaching staff should also include presenting the completion of the English language course, the frequency of which should not be less than 1 course every two years
e. be conducted at least once every four years
f. be conducted each time, immediately before a promotion related to the post held
g. be conducted by an independent commission
h. positive, conditionally positive or negative; in the case of a conditionally positive evaluation, the next periodic evaluation should take place within a period shorter than two years; in the case of a negative evaluation, the next one should conducted after one year, while obtaining another negative evaluation should result in the dismissal from the post held

7. All the abovementioned information should be published on the University website.

C. Research activity

1. The WKMOMU should create/make available the tools necessary to conduct scientific research. Specifically, this activity should be based on
    a. purchasing access to bibliographic databases
    b. purchasing access to other databases, or creating own databases (pre-clinical, clinical)
    c. introducing the function of a copywriter dealing, in a professional manner, with the editing research publications
    d. administrative assistance
        i. in preparing research grants
        ii. in obtaining patent protection
        iii. in establishing research cooperation
        iv. in seeking out partners from the broadly defined economy
    e. creating an apparatus center offering equal access to the specialized research equipment
    f. providing IT security of the collected data

2. All the abovementioned information should be published on the University website.

D. Young researchers

1. The WKMOMU authorities should make every effort to create good working conditions for people under 35 years of age, holding research and teaching posts. Specifically, these conditions should pertain to:
    a. separating funds for the research development (including financing of internal research grants, financial assistance in foreign trips)
    b. including young researchers in the university's decision-making bodies
2. It is required to develop the WKMOMU's activity in the social media, with particular emphasis on promoting the research achievements of young researchers.
3. All the abovementioned information should be published on the University website.

E. Rewarding employees

1. It is required to establish the rules for rewarding all university staff.
2. For their outstanding research achievements, research and teaching staff should be able to obtain:
    a. financial reward or
    b. an annual reduction in the contractual teaching load or
    c. financing the stay abroad (for a research conference or research internship) or
    d. additional days off
3. For their outstanding teaching achievements, research and teaching staff, as well as teaching staff members should be able to obtain:
    a. a financial reward
    b. a distinction awarded by the student organizations, which should be of considerable weight in the periodic evaluation
4. For their outstanding research achievements, research and technical staff should be able to obtain a financial reward.
5. Rewards should be awarded by the Rector upon the request of an independent committee which (e.g., on a remote basis) should also include foreigners.
6. All the above mentioned information should be published on the University website.

Attachment 1A2 – II

The WKMOMU comment on the Recommendations for the changes in the employment policy and academic staff management procedures proposed for the improvement of the effectiveness of teaching and research work

A. Types of occupied posts and working time

1. At the university, the workload of the academic staff includes a teaching load, research activity, clinical load, educational and social activities.
For professors and assistant professors (docents) of the departments (30% of the teaching staff), engaged in research projects, the teaching load is reduced to 450 hours. Their load is reduced to 45% in comparison to the previous years. 70% of the academic staff are not engaged in research projects.
3. University employees are paid for the overtime hours.
5. a. The lectures will be conducted online not more than in 50%.
b. Seminars with considering the specifics of the disciplines will be conducted online not more than in 30%.
c. The ratio of groups with regard to the academic staff is maintained, there are 10-12 people in a group.
e. Groups of students in the clinical disciplines consist of 6-8 people (internship).
f. Students' independent work is monitored during Students' Independent Work with a Teacher by the responsible teachers of the discipline, which is included in the teaching load.

B. Recruitment, development path and a periodic evaluation of the staff members

Regarding item B (1) (a, b) The university has developed procedures for the search, selection and recruitment of new employees, which are regulated by the internal regulations, such as Job descriptions, “Rules of competitive filling of positions of the academic staff and research employees of the "West Kazakhstan Marat Ospanov Medical University" NPJSC”, the procedure "Personal records: registration for work", the Employment Contract and other internal documents of WKMOMU NPJSC. Qualification requirements for the academic staff are defined in job descriptions, developed on the basis of the "Regulations on qualification requirements for the positions of academic staff and persons equated to them of the "West Kazakhstan Marat Ospanov Medical University" NPJSC".

Regarding item B (2) This item is regulated by the internal normative document - "Rules of competitive filling of positions of academic staff and research employees of the "West Kazakhstan Marat Ospanov Medical University" NPJSC" from December 23, 2020.

A competition to fill vacant positions of academic and research staff shall be held, if a vacant position is available. In case of vacant positions of the research and teaching staff, the University shall post a competition announcement on the official website of the University https://zkgmu.kz/ and the official website of the electronic labor exchange https://www.enbek.kz/. The announcement of the competition contains the following information: the name of the vacant position of the structural unit; the name of the University with the location, postal address, telephone number; the opening and closing date for the receipt of documents; the basic requirements for the participant of the competition, determined by the qualification requirements for the vacant position.

The competition procedure to fill vacant positions of the University research and teaching staff shall be based on the analysis of submitted documents of candidates, as well as on the interview and their compliance with the qualification requirements. The competition consists of three stages: a review of applications of candidates to fill vacant positions of the University research and teaching staff; interview with candidates to fill a vacant position; summarizing the results of the competition. All newly recruited employees by the University go through the induction procedure (familiarization with the new workplace, professional duties, work schedule, internal regulations, etc.).

Regarding item B (3) Each candidate for a vacant position, receives information from the Competition Commission regarding the results of voting.

Regarding item B (4) This item is regulated by an internal document - "Regulations on the Individual Professional Development Plan of the academic staff of the "West Kazakhstan Marat Ospanov Medical University" NPJSC.

In order to further develop human resources, form a new formation of academic staff, ensure the trinity of clinical practice, medical education and research activities, the University implements a policy of continuous improvement and professional development of teachers who are ready for practical and research teaching activities according to the modern international standards.

The work on the formation of the individual teacher development pathway in a particular track is conducted in the following areas: pedagogical, research; educational and methodological. The academic staff members develop an Individual Professional Development Plan (IPDP): define their professional development path (initial and planned levels of competence development, professional needs, development perspectives (goals) and implementation time frames). This pathway also includes a list of possible training courses, workshops and internships. The IPDP is a working tool that helps the teaching staff to develop the required professional skills and qualities in a planned and targeted manner, as well as to anticipate their professional development.

Regarding item B (5) Coordination and support regarding the implementation of the individual plan of professional development of teaching staff is performed by the Division of Personnel Development of the Department of Human Resources Management. Planning the individual plan of the professional development of the teaching staff is provided for 3 (three) academic years. The procedure for the approval of the individual plan of the professional development of the teaching staff: the head of the department approves the individual plan of

professional development (IPPD) of the teaching staff. The IPPD of the head of the department is approved by the dean of the faculty, or by the head of the relevant division. Reporting of the planned IPPD of the teaching staff for three years is conducted within the current academic year. The report on the teacher's IPPD is approved by the head of the department. The report on the head of the department's IPPD is approved by the profile dean or the head of the relevant division. Monitoring the implementation of the IPPD of the teaching staff is delegated to the head of the department, with accountability to the Profile Dean.

Regarding item B (6) Periodic assessment is conducted by attestation of the teaching staff, researchers and equivalent persons, and involves the assessment of the employee's compliance with the position by the results of his activities, level of qualification and personal qualities at a frequency of once every 5 years. Attestation is assigned to a competition commission for filling vacant positions of the teaching staff, researchers and other persons. The following categories of employees are not subject to attestation: employees on maternity or parental leave, pregnant women who provided a medical certificate of pregnancy (lasting more than 12 weeks), employees who have held a position for less than five years after passing the competition for this position; employees working on an hourly or part-time basis, persons of retirement age. The attestation includes a number of consecutive stages: preparation for the attestation; interview; anouncement of the decision of the competition commission.

Following the interview with an employee, the competition commission makes a final decision by expressing its choice ("attested" or "not attested") with respect to the attested employee in the ballots, by ticking the appropriate box next to the name of a given employee. The votes are counted by the secretary of the competition committee on the basis of the completed ballots and attached to the materials of the certification. The competition committee shall make recommendations for each employee certified with the expression "certified" or "not certified" according to the voting results. If an employee is "not attested", he/she shall be subject to re-attestation within a maximum of 3 months. After the re-attestation, the competition committee makes one of the following decisions: attested; not attested. If the competition commission decides that an employee is not qualified for his/her position, he/she shall be subject to the subparagraph 4) of paragraph 1 of Article 52 of the Labor Code of the Republic of Kazakhstan.

The results of the evaluation of the employee's professional performance constitute the basis for professional advancement, enrollment in the staff reserve, determination of the need for training, and may also constitute the basis for the transfer to another post, as well as the termination of the employment contract.

Regarding item B (7) All of the abovementioned information has been published on the University website https://zkgmu.kz/.

C. Research activity

The WKMOMU has subscriptions to bibliographic and full-text databases (DBs) and digital libraries (DLs) of preclinical and clinical disciplines:

- Scientific digital library eLibrary.ru

- Digital Library Lending of The Sechenov Central Scientific Medical Library
- Bukap digital library system
- “Student Consultant” DL
- “Physician's Consultant” DL
- “MedArt” DB (Analytical Inventory of Journal Articles)
- CochraneLibrary
- ClinicalKey (Elsevier)

The WKMOMU’s bibliographic databases have been created:

- Books
- Articles
- E-books
- Repository (digital library)

All information and active resource links are available at www.zkgmu.kz in the Library section (link to the library website http://biblio.zkgmu.kz:8087/jirbis2/index.php)

Administrative assistance:

During the preparation of research projects the structures of the research subunit: the Department of Scientific and Analytical Work, the Department of Research Work Management and the Scientific and Practical Centre actively help in writing the project design, for instance in 2020 there were 41 applications for external competitions, not including intrauniversity ones.

To obtain a RoK (Republic of Kazakhstan) patent and other protective documents, the Department of Research Work Management has a patent sector, where assistance and advice is available.

2. All the abovementioned information has been published on the University website: https://zkgmu.kz/ru/nauka

D. Young Researchers

The authorities of the WKMOMU highlight the work of young researchers, as evidenced by the fact that 19 young researchers are involved in 11 intrauniversity and 2 MHC (Ministry of Healthcare) grant projects. Due to the epidemic situation, young researchers within the project participate remotely in international conferences.

Achievements of young researchers have been posted on the official website of the university.

https://www.zkgmu.kz/en/announcemen-ts/news/4767-congratulations-to-batyrova-g-a-and-knisarina-m-m-on-the-successful-completion-of-their-projects-in-the-competition-for-grant-funding-announced-by-the-mes-of-the-rk
https://www.zkgmu.kz/en/announcemen-ts/news/4734-the-best-young-specialist-2020
https://www.zkgmu.kz/en/announcemen-ts/news/4611-scientific-internship-of-master-s-degree-students
https://www.zkgmu.kz/en/announcemen-ts/news/4531-results-of-the-intr-university-stage-of-the-competition-the-best-university-teacher-2020-wkmu-by-the-name-marat-ospanov
https://www.zkgmu.kz/en/announcemen-ts/news/4363-we-are-proud-of-our-students

E. Rewarding the employees

Regarding item E (1) This point is regulated by the internal regulatory document "Regulations on Awards and the Procedure of Presentation of Employees to Awards ", which defines types, status of awards, the procedure of presentation to awards and the procedure of awarding an employee in university.

The presentation of departmental awards of the Republic of Kazakhstan to the university employees is performed in accordance with the Law of the Republic of Kazakhstan "On state awards of the Republic of Kazakhstan", provision of the Government of the Republic of Kazakhstan dated December 15, 2011 № 1539 "On departmental awards of some state bodies within the structure of the Government of the Republic of Kazakhstan".

The awards of NJSC "West Kazakhstan Marat Ospanov Medical University" is a form of encouragement and stimulation of the University employees for their merits and achievements in professional activity and a significant contribution to the development of the University. The decision with regard to awarding rests with the Chairman of the Board – the Rector on the basis of the recommendation of the Commission on awards. The Commission on awards is a collegial and advisory body and has been established to resolve the issues related to stimulating the work of employees by means of awards, identifying candidates for state awards, departmental and other awards, incentives and distinctions.

Regarding item E (2) Academic staff involved in research activities at the expense of participation in research and technical programs of internal and national funding have the opportunity to receive financial compensation, as well as funding for the stays abroad (to participate in a research conference or a research internship).

Regarding item E (3) Academic staff who are involved in teaching activities at the expense of participation in intramural and national competitions, such as "The best university teacher", and have the opportunity to receive financial remuneration.

Regarding item E (4) Research and technical staff members have an opportunity to receive financial remuneration for the participation in research and technical programs of intramural and republican financing.

Regarding item E (5) The decision with regard to awarding rests with the Chairman of the Board – the Rector on the basis of the recommendation of the Commission on awards.

Regarding item E (6) All the above mentioned information has been published on the University website https://zkgmu.kz/.

Financial rewards are provided in the “Provision on labor remuneration, rewards, financial assistance, and other social payments for employees of the “West Kazakhstan Marat Ospanov Medical University” Non-Profit Joint-Stock Company”.

Attachment 1A.2 - III

The appendix to the Report with the suggested changes in the academic staff management policy and procedures

On the basis of the recommendations with regard to the changes in the academic staff management policy and procedures (presented to the WKMOMU in 2020), as well as WKMOMU comments and an on-line meeting held in February 2021, the following conclusions have been established.

A. The recruitment procedure, working time, development path and periodic assessment. Rewarding of the employees.

1. Following our recommendations, the WKMOMU has developed new internal procedures and normative documents (dated December 2020) for the selection and development of new research and teaching staff members. In particular, they aim to address (1) the announcement procedure, (2) the required application documents, (3) the interview, (4) the final selection of the candidates, as well as (5) rewarding of the employees.
2. PUMS experts approve the implementation of the individual plan of professional development which should be provided by all the present and future research and teaching employees at WKMOMU.
3. It should be noted that the tendency initiated at the WKMOMU to reduce the number of teaching hours for professors is headed in the right direction. However, the number of 450 hours for professors and assistant professors (even if they comprise self-study on the part of the students) is too high. In the experts' opinion, this number should be further decreased, according to the presentation during the on-line meeting.
4. The payment for the overtime hours has been introduced as recommended. Nevertheless, these rates should vary depending on the position held.
5. The number of students, in particular regarding the groups in the contact pre-clinical classes (10-12 students) and the clinical groups (6-8 students), has been accepted by the experts.
6. It is difficult for PUMS experts to accept that the periodic assessment of the teaching and research staff members is performed every five years. It remains clear that this constitutes a state regulation, and the WKMOMU must follow these procedures. The experts still recommend, however, that such a periodic assessment (even performed every 5 years) could be supplemented by an internal mid-term evaluation. Such an assessment could further indicate possible shortcomings and result in the implementation of an individual improvement program.

B. Research activity and young researchers

1. The PUMS experts approve all the subscriptions of the WKMOMU with regard to the bibliographic and full-text databases and digital libraries.
2. In the opinion of the experts, the introduction of the Department of Scientific and Analytical Work (launched in 2020) is a real achievement of the WKMOMU authorities. This department provides assistance in writing research applications for external competitions.
3. The experts still recommend the development of a facility at the WKMOMU which would be the repository for the specialized research equipment.
4. The number of young researchers who are currently employed at WKMOMU is sufficient. The experts have highlighted the need of employing young researchers every year to cover the retiring academics and those who do not comply with the conditions of the periodic assessment.

Attachment 1A.3 – I

The improvement plan for the clinical training at the selected clinical facilities of the WKMOMU

Introduction

The task 1A.3) entitled "Development of the action plan on the effective clinical training at clinical facilities," was focused on the analysis of the current clinical training of students at the clinical facilities at the WKMOMU. Moreover, it addressed the methods for teaching quality evaluation, a comparison of the methods used at the WKMOMU and PUMS, and the preparation of the improvement plan for the clinical training at the WKMOMU.

The implementation of this task was divided into two phases. The tasks and the time frames included Phase 1 are shown in Table 1.

Table 1: Phase 1 tasks and time frames

	Time frame
Choosing the four most representative clinical training facilities at the WKMOMU based on teaching	August 2019 – September 2019
Analysis of the currently used teaching methods quality evaluation at the WKMOMU	November 2019 – December 2019
Comparison of the methods used at the WKMOMU and PUMS	January 2020 – February 2020

The tasks scheduled for the period since August 2019 until February 2020 were fully completed. Phase 2 of the task was scheduled for the period since March 2020 to March 2021. Phase 2 tasks and their time frames are shown in Table 2.

Table 2: Phase 2 tasks and their time frames.

	Time frame
Preparation of the student survey-based teaching quality evaluation methods for the WKMOMU by the PUMS specialists.	March 2020 – April 2020
A visit of the PUMS experts in Aktobe to present the suggested student survey-based teaching quality evaluation methods and to discuss the selected clinical training facilities at the WKMOMU.	May 2020
Preparation of a plan for the improvement of the clinical training for the students in some selected clinical facilities.	June 2020 – September 2020
A visit of the PUMS experts in Aktobe, presenting the prepared plan to improve the clinical training, and collect the WKMOMU staff opinions.	October 2020
Preparation of the corrected plan for improvement of the clinical training at the WKMOMU.	November 2020 – February 2021
A visit of the PUMS experts in Aktobe, presenting the final plan for improving clinical training at the WKMOMU.	March 2021
Preparation of the final plan for improvement of clinical training at the WKMOMU.	March 2021

The implementation of this Phase featured some unexpected obstacles due to the pandemic of COVID-19. First of all, expert missions were impossible due to travel restrictions. Three visits of the PUMS experts at the WKMOMU were scheduled for May 2020, in October 2020, and in March 2021. As a result, the personal observation of the clinical training at the WKMOMU by the PUMS expert proved to be impossible. Therefore, the detailed analysis of the chosen four most representative clinical training syllabi turned out to be a more critical part of this Phase. According to the research performed at Phase 1, PUMS experts analyzed the syllabi of Internal Medicine, General Medicine, Pediatrics, and Surgery. They also compared the syllabi prepared at the WKMOMU with those present in Poland to develop detailed guidelines for improving clinical teaching quality at the WKMOMU.

Instead of the impossible personal observation of clinical training in Aktobe, a questionnaire was prepared for the academic teachers in Aktobe responsible for the selected areas to collect information concerning how these trainings were conducted. The questionnaire used in this Phase is presented in Appendix 1.

An essential addition to the expert-assessed materials was the student-based teaching quality evaluation questionnaires. The analysis of the students' opinions allowed for a more objective assessment of the clinical training at the WKMOMU and learning about the students' expectations concerning the clinical training.

The detailed analysis of the four selected clinical training results, the results of the student-based teaching quality evaluation questionnaires, and the final improvement plan for the clinical training at the WKMOMU are presented in the subsequent sections of this chapter.

The analysis of the current state of the clinical training at clinical facilities at the WKMOMU was outperformed by means of three methods: a review of the syllabi of the four courses mentioned below, a survey of academic teachers who responded to detailed questions about the way they organize the clinical training and by a survey of student satisfaction with clinical teaching on General Practice course.

The four main courses' syllabi: Internal medicine, Pediatrics, Surgery, and General Medicine/Family Medicine were analyzed in detail by the PUMS experts – specialists in relevant fields of medicine. The main goal of this analysis was to indicate directions for improving the clinical training quality. The analysis of the syllabi was supplemented with a description of the methods used in clinical training obtained from questionnaires for academic teachers.

The results of the review of the selected syllabi supplemented by the results of an online survey for the WKMOMU students was the base to prepare the improvement plan for the clinical training at the selected clinical facilities of the WKMOMU.

General remarks

An introduction of a new education system for the medical students always constitutes a great challenge. The present and future students certainly prefer different types of learning, such as work-based learning, solving a problem or being presented with a scenario. Irrespective of the chosen learning type, it should be taken into consideration that once a teaching model has been approved, further education should not be subject to rapid changes. Therefore, before such a decision is made, it is worth learning about the different models of the medical students' education.

There are generally three approaches to the training provided at medical schools all over the world.

Traditional pre-clinical and clinical courses

For the traditional courses, the medical education is usually divided into two years of 'pre-clinical' classes (involving study of the basic medical sciences) and four years of 'clinical' courses, during which they work in hospitals under the supervision of consultants.

Throughout the final four years, they also attend lectures on all aspects of medical practice. This is a kind of subject-based course of lectures, where one can participate in the separate courses of anatomy, physiology, biochemistry etc.

Integrated/systems-based courses

Integrated courses which the majority of medical schools now have implemented, integrate what was previously learnt at the pre-clinical and clinical stages, to provide a seamless course. Teaching methods can include problem-based learning (PBL) and practical clinical skills.

Integrated courses are currently the most recommended approach to medicine. Instead of conducting separate courses on anatomy and physiology etc., the idea is to join them into systems (also known as the systems-based approach) where you will discuss a bodily system, such as the circulatory system, and simultaneously consider the anatomy, physiology, biochemistry, pharmacology, pathology.

Problem based learning (PBL)

PBL constitutes a very patient-oriented approach and students can expect to see patients right from the beginning of their training course.

Students are given medical cases to be solved and learn from, on the basis of group work with a tutor, as well as by means of self-directed learning. Group work, alongside academic and clinical learning, helps students develop communication, teamwork and problem-solving skills, personal responsibility and respect for others.

PBL is an 'open inquiry' approach where instructors play a minimal role and do not guide the discussion. The system, however, is extremely difficult to implement. Therefore, at present there are very few medical schools in the world using a pure PBL approach in their curricula.

Taking into consideration the experience of Poznan University of Medical Science (PUMS), we would particularly advise you to conduct the first two years of studies in the traditional formula (subject-based course). Then to include the systems-based courses in the subsequent three years and, finally, to plan the last - sixth year exclusively in hospitals to introduce your medical students into the clinical practice. This year should consist of four parts: internal medicine (16 weeks), surgery (6 weeks), pediatrics (6 weeks), and gynecology and obstetrics (4 weeks). We are well aware of the fact that the subject of this report is not to discuss the concept of the first two years and the last year of the WKMOMU medical studies. Therefore, in the following part we only refer to the three clinical years defined as the 3rd, 4th and 5th year of study (semesters 5-10).

1. Clinical Examination Courses – Internal Medicine and Neurology

Semester (year): 5 (3)

Type of course: lecture, practical classes, large group seminar, tutorial

Content:	anamnesis, locomotor system, nervous system I and II, cardiovascular system, respiratory system, neck, thyroid, gastrointestinal system

2. Pathomechanisms

Semester (year): 5 (3)

Type of course: lecture, practical classes, large group seminar, tutorial

Content:	principle of cause and effect, relation of structure and function, the clinical picture as model, parameters of defective structure and / or function

3. Pharmacology / Toxicology

Semester (year): 5 (3)

Type of course: lecture, practical classes, seminar, tutorial

Content:	general principles of pharmacodynamics and pharmacokinetics, drugs acting at the synaptic and neuroeffector junctional sites, drugs affecting renal and cardiovascular function, drugs acting on the blood and blood forming organs, drugs affecting gastrointestinal function, autacoids, drug therapy or inflammation, opioid analgesics, drug abuse, hormones and hormone antagonists, drugs acting on the central nervous system, general and local anesthetics, drugs and the treatment of neurological and CNS disorders, toxicology (heavy metal and heavy metal antagonists, toxicology of air, pollutants, pesticides, solvents and vapors, naturally occurring toxins), chemotherapy of microbial and neoplastic diseases and of parasitic infections

4. Forensic Medicine

Semester (year): 5 (3)

Type of course: lecture, practical classes

Content:	toxicology, analysis, thanatology, kinds of death, forensic medicine, medical ethics

5. History, Theory and Ethics in Medicine

Semester (year): 5 and 6 (3)

Type of course: lecture, seminar

Content:	the patient in his / her individual and social situation, diseases and society, change of conceptions on health and diseases over the centuries, medical

	profession status, medical institutions, ethical aspects of medical diagnosis and treatment, reasoning and knowledge of physicians, events and figures who significantly contributed to the evolution of medicine, naturopathy in the 19th and 20th century

6. Emergency Medicine

Semester (year): 6 (3)

Type of course: lecture, practical classes, tutorial, shadowing in the operating theatre

Content:	control, monitoring and recovery of vital functions, cardiovascular resuscitation, recovery, bedding, retrieval and transportation of injured persons, diagnosis and treatment of acute disorders of: the respiratory system, cardiovascular system, awareness, acute metabolic disorders, treatment of acute pain and acute pain syndromes, special emergency

7. Infectious Diseases

Semester (year): 6 (3)

Type of course: lecture, practical classes, seminar, large group seminar, tutorial

Content:	general microbial infection, general bacteriology, diagnosis of infectious diseases, normal resident flora, special bacteriology, mycology, parasitology, principles of antimicrobial, antifungal therapy, antiprotozoals, and anthelmintics, immunoprophylaxis, clinical infectious diseases after organ specific areas, hospital hygiene, environmental hygiene, food and water hygiene, infection control guidelines, general virology, special virology, antivirals, principles of normal and pathological immune functions, immune defense, pathology of inflammatory response, malignant lymphomata, pathology of HIV infection

8. Medical Imaging, Radiotherapy, Radiation Protection

Semester (year): 6 (3)

Type of course: lecture, seminar

Content:	basic radiology, respiratory system, cardiovascular system, skeletal system and soft tissues, gastrointestinal tract, genitourinary system, CNS and skull, CT, NMR, nuclear diagnostics and therapy, radiation protection, basic physics of the ionizing radiation and radioactivity, dosimetry, biological effects of radiation, legal aspects of nuclear medicine

9. Health Economics, Health System, Public Health

Semester (year): 6 (3)

Type of course: lecture, tutorial

Content:	quality management, hospital and outpatient management, disease management programs, basic medical guidelines, health systems, integrated care, economic analysis of health systems and services

10. Epidemiology, Medical Biometry, Medical Informatics

Semester (year): 6 (3)

Type of course: lecture, tutorial

Content:	principles of epidemiology, clinical epidemiology, evidence-based medicine, meta-analyzes, types of studies, planning of clinical studies, description of empirical observations, estimating outcomes, planning and evaluation of treatment comparisons, medical classification systems (ICD, DRG), information systems in health care, quality management, hospital and outpatient management, disease management programs, basic medical guidelines, health systems, integrated care, economic analysis of health systems and services

11. Heart, Circulation, Lung

Semester (year): 7 (4)

Type of course: lecture, tutorial, bedside teaching

Content:	non-invasive angiological diagnostic and vascular ultrasound, pulmonary function course

12. Skin, Muscle, Joints

Semester (year): 7 (4)

Type of course: lecture, practical classes, seminar, tutorial, bedside teaching

Content:	theoretical approach to diseases of the skin, sexual transmitted and autoimmune diseases and diseases of the locomotor system: efflorescence, allergology, neurodermatitis, urticaria, exanthem, autoimmune diseases, collagen diseases, psoriasis and inflammatory dermatoses, acne and rosacea, venerology and STD, HIV / AIDS, pediatric dermatology, genodermatoses, benign and malignant skin tumor, paraneoplastic syndrome, age-and light-related skin lesions, diseases of the skin appendages, phlebology and venous ulceration, wound healing, proctology, andrology, important rheumatological diseases, principles and choice of immunosuppressive therapy, the importance of interdisciplinary collaboration,

	investigation techniques of the upper and lower extremities, spine, diseases of the shoulder joints and knee joints, degenerative joint diseases and joint replacement, pediatric orthopedics, congenital and acquired foot deformities, spinal diseases, rheumatoid arthritis, inflammatory diseases of the joints and bones, sports medicine, tumors of locomotor system, orthopedic emergencies; bedside teaching in Dermatology

13. Rehabilitation, Physical Medicine, Treatment in Natural Medicine

Semester (year): 7 (4)

Type of course: lecture

Content:	complementary and alternative medicine methods, classical naturopathy 1: principle (stimulus - response - regulation), possibilities and limitations, important individual processes, classical naturopathy 2: complex naturopathic approaches, health resort medicine, physiotherapy, rehabilitation in the musculoskeletal area, internist cardiac rehabilitation, phytopharmaceuticals

14. Clinical Pathology

Semester (year): 7 and 8 (4)

Type of course: lecture, large group seminar

Content:	joints, bones: inflammation and osteopathy; soft tissue: inflammation; bone / soft tissue: tumors and tumor-like lesions; vasculopathy / vasculitis / venous vessels; myocardial infarction / myocarditis / cardiomyopathy; endocarditis / congenital and acquired valve disease; heart and vessels: neoplasia; lung: inflammation, neoplasia; upper GI tract: neoplasia, inflammation; liver, gallbladder, pancreas: neoplasia, inflammation, cirrhosis; endocrine: neoplasia, inflammation, hyperplasia; uropathology: neoplasia, inflammation; nephropathology: inflammation, degenerative changes; prostate, testis: neoplasia; gynecological pathology: neoplasia

15. Human Genetics

Semester (year): 7 and 8 (4)

Type of course: lecture, practical classes, seminar, large group seminar, tutorial

Content:	diagnosis of dysmorphology and syndromes, syndromes with micro-and macrocephaly, syndromes with large and small stature, prenatal diagnosis, intersex, from phenotype to mutation at a basic and advanced level, genetics and ethics, craniofacial dysmorphism

16. General Medicine. Theory

Semester (year): 7 and 8 (4)

Type of course: seminar

Content:	introduction, frequent consulting occasions; psychosomatics in general practice; multimorbidity and chronic diseases; life care and palliative care, immunization, prevention, home visits, emergencies

17. Pediatric Surgery. Theory

Semester (year): 8 (4)

Type of course: lecture

Content:	pediatric diseases of the head and back region, congenital malformations of the chest and the lungs, diseases of the anterior abdominal wall and the diaphragm, diseases of the abdomen, outpatient pediatric surgery, pediatric traumatology, pediatric urology

18. Internal medicine. Practicals part I

Semester (year): 8 (4)

Type of course: clinical training

19. Nutrition, Metabolism, Digestion

Semester (year): 8 (4)

Type of course: lecture, practical classes, large group seminar, tutorial, bedside teaching

Content:	interdisciplinary teaching of diseases of the respective organs and their malfunctions, interdisciplinary treatment of chronic diseases, presentation of important cross-correlations, genetics of complex diseases in the theme of nutrition, metabolism, digestion, hereditary kidney disease

20. Oncology

Semester (year): 8 (4)

Type of course: lecture, practical classes, large group seminar, tutorial, bedside teaching

Content:	etiology, pathogenesis, diagnosis and therapeutic principles of malignant diseases, aftercare, communication skills, palliative care, quality of life of patients with malignant diseases

21. Palliative Care

Semester (year): 8 (4)

Type of course: lecture, practical classes, seminar, large group seminar, bedside teaching

Content:	care in end-of-life situations (oncology, pediatrics, geriatrics, neurology): effective pain management, relief of symptoms, professional psychosocial and spiritual support, ethics in end of life situations

22. Pediatrics. Theory

Semester (year): 8 (4) and 9 (5)

Type of course: lecture

Content:	pediatric traumatology, head and neck, thorax, diaphragm, lungs, abdominal wall, urogenital, coccygeal teratomas, abdomen, ileus, atresia, neonatology, developmental neurology, rheumatology, clotting disorders, endocrinology, nutrition in childhood, gastroenterology, pediatric: cardiology, hematology, oncology, respiratory emergencies, pulmonology, infectious diseases

23. Emergency Medical Aid, Injuries, Intensive Care

Semester (year): 9 (5)

Type of course: lecture, practical classes, tutorial, bedside teaching

Content:	principles of general anesthesia and regional anesthesia, acute and chronic pain, pain diagnosis, methods of pain treatment, shock treatment, liquid and volume replacement therapy, treatment with blood products, principles of diagnosis and treatment of life-threatening diseases (trauma, sepsis, respiratory failure, acute hemorrhage, CNS injury), principles of intensive care (mechanical ventilation, drug therapy, artificial nutrition, artificial organs), monitoring, aspects of intensive medical care, life-threatening disorders of the respiratory system, the cardiovascular system, CNS, including comas and other special emergency situations, trauma genesis, pathophysiology of various injuries, fracture theory, treatment of bone, joint and soft tissue injuries, reconstruction of limbs, amputation, rehabilitation

24. Gynecology and Obstetrics. Theory

Semester (year): 9 (5)

Type of course: lecture

Content:	endocrinology of the menstrual cycle, menstrual disorders, child and adolescent gynecology, menopause, contraception, sterility and infertility, physiology of pregnancy, prenatal care, diseases during pregnancy, prenatal diagnosis, multiple pregnancy, prematurity, regular and irregular birth, infections of the genital, benign genital diseases, cervical cancer, endometrial cancer, ovarian

	cancer, breast cancer, mastitis, changes of position of the female genitals, urogynecology

25. Neurology. Theory

Semester (year): 9 (5)

Type of course: lecture

Content:	pathology of cranial nerves, neuroanatomy, pathology of infections, immune diseases, extrapyramidal disorders, dementia, cranial tumors, stroke, headache, dizziness and vertigo, neuromuscular diseases, multiple sclerosis, epilepsy, neuroophthalmology, intensive care medicine, brain death, psychosomatic neurology

26. Psychiatry. Theory

Semester (year): 9 (5)

Type of course: lecture, seminar

Content:	structure and records of psychiatric examinations, psychological findings, normal findings, perceptual disturbances / hallucinations, disturbances of the self-experience, thought disorder, formal thought and language disorders, behavioral disorders, disorders in motor and psychomotor performance, constraints, affectivity, disorders of attention and memory; disorders in the awareness and orientation

27. Psychosomatics. Theory

Semester (year); 9 (5)

Type of course: lecture, seminar

Content:	definition and explanation of the dimensions of psychosomatic medicine, spectrum of disease / epidemiology, research principles, disease concepts, stress, conversion, theoretical concepts of learning, differentiation from other psychological subjects

28. Head

Semester (year): 9 (5)

Type of course: lecture, tutorial

Content:	diagnosis and treatment of the disorders of the cranium, neck, eyes, ears, nose, sinuses, teeth, oral cavity or other facial or cranial structures

29. Prevention

Semester (year): 9 (5)

Type of course: lecture, tutorial, bedside teaching

Content:	psychosomatic medicine and the environment, biomonitoring in occupational and environmental medicine, natural born killers - the environment as a source of infection, epidemiological principles of preventive medicine, diseases in preventive medicine, evidence based preventive medicine, effects of noise and noise prevention, disease and health concepts, socioeconomic influences on health and health care, prevention of allergic diseases, prevention of mental disorders, health-damaging and health-promoting behavior in the mirror of health reporting

30. Internal medicine. Practicals part II

Semester (year): 10 (5)

Type of course: bedside teaching

31. Clinical Pharmacology

Semester (year): 10 (5)

Type of course: lecture, seminar

Content:	pharmaceuticals, formulation, special populations, pregnancy and lactation, pharmacokinetics / genetics, psychotropic drugs, adverse drug reactions, immunopharmacology, coagulation / platelet aggregation, antibiotics, drug epidemiology, heart failure, EBM drug therapy, CHD / hypertension

32. General Medicine. Practicals

Semester (year): 10 (5)

Type of course: bedside teaching

Content:	introduction, frequent consulting occasions; psychosomatics in general practice; multimorbidity and chronic diseases; life care and palliative care, immunization, prevention, home visits, emergencies

33. Geriatric medicine

Semester (year): 10 (5)

Type of course: lecture, seminar

Content:	principles of pharmacotherapy for the elderly, angiological problems in old age, tumor diseases of old age, urological problems of old age, metabolic diseases, movement disorders - neurological gait disorders of old age, socio-medical aspects and physical therapy for the elderly, geriatric psychiatry 1 (delirium and

	dementia), geriatric psychiatry 2 (depression), osteoarthritis, hip and knee complaints, degenerative changes of old age (spine), dental care in old age, orthostatic hypotension and other disorders of old age, surgery of old age

34. Gynecology and Obstetrics. Practicals

Semester (year): 10 (5)

Type of course: bedside teaching

Content:	endocrinology of the menstrual cycle, menstrual disorders, child and adolescent gynecology, menopause, contraception, sterility and infertility, physiology of pregnancy, prenatal care, diseases during pregnancy, prenatal diagnosis, multiple pregnancy, prematurity, regular and irregular birth, infections of the genital, benign genital diseases, cervical cancer, endometrial cancer, ovarian cancer, breast cancer, mastitis, changes of position of the female genitals, urogynecology

35. Neurology. Practicals

Semester (year): 10 (5)

Type of course: bedside teaching

Content:	pathology of cranial nerves, neuroanatomy, pathology of infections, immune diseases, extrapyramidal disorders, dementia, cranial tumors, stroke, headache, dizziness and vertigo, neuromuscular diseases, multiple sclerosis, epilepsy, neuroophthalmology, intensive care medicine, brain death, psychosomatic neurology

36. Pediatrics. Practicals

Semester (year): 10 (5)

Type of course: bedside teaching

Content:	pediatric traumatology, head and neck, thorax, diaphragm, lungs, abdominal wall, urogenital, coccygeal teratomas, abdomen, ileus, atresia, neonatology, developmental neurology, rheumatology, clotting disorders, endocrinology, nutrition in childhood, gastroenterology, pediatric cardiology, hematology, oncology, respiratory emergencies, pulmonology, infectious diseases

37. Psychiatry. Practicals

Semester (year): 10 (5)

Type of course: bedside teaching

Content:	structure and records of psychiatric examinations, psychological findings, normal findings, perceptual disturbances / hallucinations, disturbances of the

	self-experience, thought disorders, formal thought and language disorders, behavioral disorders, disorders in motor and psychomotor performance, constraints, affectivity, disorders of attention and memory; disorders in the awareness and orientation

38. Psychosomatics. Practicals
Semester (year); 10 (5)
Type of course: bedside teaching

Content:	definition and explanation of the dimensions of psychosomatic medicine, spectrum of disease / epidemiology, research principles, disease concepts, stress, conversion, theoretical concepts of learning, differentiation from other psychological subjects

39. Surgery. Practicals
Semester (year): 10 (5)
Type of course: bedside teaching

40. Ophthalmology. Practicals
Semester (year): 10 (5)
Type of course: bedside teaching

41. Otolaryngology. Practicals
Semester (year): 10 (5)
Type of course: bedside teaching

42. Summer clinical elective. Practicals
Semester: after 6th, 8th and 10th semester
Type of course: bedside teaching, tutorial

A. Surgery. Theory.
Included in "Heart, Circulation, Lung"; "Skin, Muscle, Joints"; "Nutrition, Metabolism, Digestion" and "Pediatric Surgery"

B. Internal Medicine. Theory
Included in "Heart, Circulation, Lung"; "Skin, Muscle, Joints"; "Nutrition, Metabolism, Digestion" and "Oncology"

C. Ophthalmology. Theory

Included in "Head"

D. Otolaryngology. Theory
Included in "Head"

Glossary

Lecture = an oral presentation intended to present information, or teach students about a particular subject. It is used to convey critical information, history, background, theories, and equations. It should not be longer than 1 hour 30 minutes. A lecture is conducted for all the students of the entire year, either in direct contactor the on-line mode. It can be scheduled in the morning or in the afternoon.

Practical classes= developing skills and knowledge which relate to specific useful competencies. They are conducted in groups of up to 8 students under a constant supervision of an academic teacher. Such classes should not be longer than 2 hours and 15 minutes. They should start in the morning.

Large group seminar - interactive (mostly theoretical) activities conducted by one academic teacher for a maximum of 24 students. It should not be longer than 1 hour 30 minutes. It can be scheduled in the morning or in the afternoon.

Seminar - interactive (mostly theoretical) activities conducted by one academic teacher for a maximum of 12 students. It should not be longer than 1 hour 30 minutes. It can be scheduled in the morning or in the afternoon

Tutorial = non-standard classes conducted by one academic teacher for a group of up to 24 students, the aim of which is a multidisciplinary approach to the discussed issue, it should be conducted as necessary, duration - no more than 1 hour and 30 minutes

Shadowing in the operating theatre = presenting a real-life surgery. No more than 4 students should be present at the operating room at one moment. The duration of the classes should be based on the complexity of the surgical procedures performed. It can be scheduled both in the morning and in the afternoon (also including weekends)

Bedside teaching = teaching in the presence of a patient. Performed in groups of up to 6 students under a constant supervision of an academic teacher. It can be performed in hospitals, as well as

in the outpatient and emergency units. It should not be longer than 2 hours and 15 minutes. Implementation - should start in the morning.
Usually, should be preceded by large group seminars or seminars.

Internal medicine

Detailed remarks

1. **Principles of internal diseases**
   - The construction of the syllabus is legible (it could be considered a model for other syllabi).
   - Teaching methods are appropriate.
     - Learning Outcomes could be supplemented with regard to certain skills: follow the rules of professional ethics; prioritize the welfare of and show respect for patients and the social groups.
   - The subject content could be supplemented regarding certain issues: hypothalamus and pituitary gland diseases, adrenal glands diseases, diagnosis of jaundice, disorders of calcium and phosphate metabolism, Hodgkin and non-Hodgkin lymphomas.
   - Criteria and regulations of knowledge evaluation are appropriate.
   - Basic and additional references could be expanded.

2. **Fundamentals of internal diseases (undergraduate program)**
   - The syllabus "Principles of internal diseases" (undergraduate program) is similar in its scope to the "Principles of internal diseases" mentioned above. Slight differences can be seen in the "discipline policy" and references (there are more items in this section), while the "learning outcomes" and "the subject content" are almost the same. Thus, the additions to this syllabus have been provided above.

3. **Propaedeutics of internal diseases**
   - The syllabus may be improved in terms of construction (i.e., discipline policy and organization of educational process could be presented in the form of table – such a version would be easier for students).
   - The syllabus seems to be appropriate in terms of learning outcomes and the subject content. It is an introduction to "Principles of internal diseases".

4. **Respiratory system**

   - Information about teachers and discipline policy could be presented in a table.
   - "The results of training" instead of "educational outcomes" could be supplemented in the scope of "Knowledge and understanding", e.g., know the environmental and

epidemiological conditions of the most common respiratory diseases; know the detailed organs pathology, macro- and microscopic images and the clinical course of the pathomorphological changes in the respiratory system.

- The subject content could be supplemented with regard to certain issues: hemoglobin, the participation of hemoglobin in the transport of oxygen and carbon dioxide, the body's adaptation mechanisms to the conditions of hypoxia and reduced oxygen pressure (high altitude); mechanism of carbon dioxide (CO_2) poisoning.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are very extensive.

5. Cardiovascular system

- Information about teacher, contact and discipline policy should be added.
- "Learning outcomes" instead of "educational outcomes" could be completed in the area of "Knowledge and understanding", e.g., know the activity and mechanisms of regulation of every organs and systems in the human body, including cardiovascular system and the area of "Learning Skills or Learning Abilities", e.g. is aware of his own limitations and knows when to refer to other professionals.
- The subject content could be supplemented with regard to certain issues: pathophysiology and pathomorphology of the heart, resting and functional potential of heart cells.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are very extensive.

6. Digestive system

- Information about teachers and discipline policy could be presented in a table.
- "The end results of training" instead of "educational outcomes" could be completed in the area of "Knowledge and understanding", e.g. know the environmental and epidemiological conditions of the most common digestive diseases.
- The subject content could be supplemented with regard to certain issues: malabsorption syndrome, inflammatory bowel diseases.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are very extensive.

7. Diseases of connective tissue

- Information about teacher, contact and discipline policy should be added.
- "The end results of training" instead of "educational outcomes" could be completed in the area of "Communicative ability" and "Learning skills or learning ability" according to other syllabi regarding the Internal diseases.
- Syllabus seems to be appropriate in terms of the subject content.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are very extensive.

8. Diseases of hematopoietic organs

- Information about teachers and discipline policy could be presented in a table.
- "The end results of training" instead of "educational outcomes" seems to be appropriate.
- The subject content could be supplemented with regard to the information concerning Hodgkin and non-Hodgkin lymphomas.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are extensive.

9. Urogenital system

- Information about teachers and discipline policy could be presented in a table.
- "The end results of training" instead of "educational outcomes" seems to be appropriate.
- Syllabus seems to be appropriate in terms of the subject content.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are extensive.

10. Endocrine systems

- Information about teachers and discipline policy could be presented in a table.
- "Learning outcomes" instead of "educational outcomes" seems to be appropriate.
- The subject content could be supplemented with regard to more information concerning diabetes, e.g. insulin preparations, pens, glucometers, insulin pumps; bloodless glucose concentration monitoring systems; selected clinical problems in diabetic patients, including psychological aspects.
- Criteria and regulations of knowledge evaluation are appropriate.

- References are extensive.

Pediatrics

Propaedeutics of Pediatrics - conclusions

The presented Syllabus of the Propaedeutics of children's diseases contains well-described learning outcomes, including all the necessary elements. A particular shortcoming is a weak emphasis on the subject of a healthy child. Issues of semiotics and child examination are covered sufficiently and in detail. Additionally, the communication skills cover all relevant areas of clinical teaching in pediatrics. The Educational outcomes are well described and need only minor corrections.

In practical classes during which students work together in small groups with the teacher, the main emphasis is on the child's anatomy and physiology. The issues of a healthy child, health promotion, and prevention in Pediatrics seem to be addressed insufficiently. Consideration should be given to the practical issues which are more interesting for the students, and more useful in the daily doctor's practice.

The Student Self-study needs some modifications in terms of hours, selected topics, and teaching methods. In the current program, the issues of this part of the clinical training are focused on child physiology. If this part of the course was to remain as self-study, the topics should be modified to solve some prepared clinical problems of a healthy child, e.g., to design feeding schedules for a particular child, evaluate the development of children described in given cases, or design some vaccination schedules.

A detailed analysis of the syllabus of Propaedeutics of Pediatrics is presented in the attachment A1.3 – III.

The principles of children's diseases

The final results of the clinical training are described in detail in five parts. In the first one, entitled "Knowing and understanding", the main emphasis is placed on preparing the student to work in the clinical and paraclinical units of children's hospital, including medical records of pediatric departments, its purpose, and the order of conducting. This description shows that the primary goal of the clinical training in pediatrics is to prepare a specialist to work in a hospital setting. This teaching direction in pediatrics is different from the solutions adopted at the European universities. The main objective is to prepare a family doctor who can also provide day-to-day care for children in the outpatient conditions. This field of education requires more emphasis on the issues of a healthy child, as well as on the activities related to health promotion and disease prevention. At the same time, there is no detailed preparation for work in specialized hospitals. These differences probably stem from the tradition of training physicians in Kazakhstan and from a different model of health care. However, they may constitute a significant obstacle in the cooperation between the Kazakh's and Europeans Universities in the medical education. For

most European students, the principles of children's diseases are too broad and too specialized. Furthermore, these differences are also visible in the second part of the formed competencies - "Applying knowledge and understanding". Additionally, some specific competencies combined with the child development and a child's examination have also been mentioned, e.g., registration of medical records of the pediatric department. The advantages of the chosen competencies are the communicative skills and the learning skills or learning abilities. In fact, the range of skills in the area of interpersonal communication is broad, and it includes, such elements as providing information to the patients and their parents, responding to various emotions of patients and their relatives, and interacting with other specialists involved in this particular area of patient care.

The most essential elements comprise learning skills, described as the ability and willingness to acquire new knowledge necessary for daily professional activities, as well as the ability to apply modern medical research achievements in the individual approach in the treatment of a particular patient.

Summarizing, the crucial decision is to choose between an undergraduate-specialist education in Pediatrics and a General Practitioner. If the second option is chosen, the described formed competencies should be modified.

The distribution of teaching hours is presented in Table 2.

Table 2: The distribution of teaching hours.

Discipline	Number of credits	Hours	Including			Form of assessment
			PC	SSS	SSWT	
Principles of children's diseases	5	225	12/63	75	75	Exam: 1st stage – assessment test 2nd – OSCE - practical skills assessment

Explanation of abbreviations: PC – practical classes; SIW – Student Self-study;
SIWT – Student Self-study under a tutor's supervision; OSCE – Objective Structured Clinical Examination

A total number of teaching hours is 225 including 12 hours of lectures. The lectures are mainly devoted to the diagnostics, treatment, and prevention of the diseases of different organs analyzed on the basis of evidence-based medicine.

Practical classes are provided without the participation of patients. The students work in small groups together with the teacher. These classes comprise 23 detailed topics delivered over 63 hours. Among the topics, apart from certain fundamental issues, there are also some very

specialist ones. During these classes, the student is introduced to a wide range of pediatrics beyond the requirements specified for a family physician.

The most important part of this clinical training is the Student Self-study under a tutor's supervision. This portion of the pediatrics course includes 75 hours devoted to pediatric subspecialties, ranging from rheumatology through gastroenterology, nephrology, pulmonology, to hematology. An indispensable component of this part of the clinical training is the analysis of prepared the clinical cases illustrating particular diseases, both as a group and with the teacher. This part of the clinical training provides the student with a unique opportunity to analyze more common and more complicated cases with the tutor's guidelines.

A more traditional part of the clinical training is the Student Self-study, which includes preparing four abstracts on the assigned topics. This part also includes 10 hours of child supervision with an assessment of physical, neuropsychic, and sexual development, a conversation with a mother, or a caregiver on the organization of the regimen, care, as well as feeding the child. This part of the clinical training is focused rather on the practical aspects than on the Propaedeutics of children's diseases.

Credit for the course is awarded on the basis of a two-stage examination. The first part consists of an assessment test. The second one is The Objective Structured Clinical Examination, which is currently the most popular method of evaluating the knowledge and practical skills of a student in most clinical disciplines.

Conclusions:

The presented syllabus of The Principles of Children's Diseases constitutes a valuable document, which was prepared for the clinical training of future specialists in pediatrics, rather than General Practitioners. The content of this course is too broad and too specialized. In addition, some typical competencies combined with the child development and child examination have also been listed, e.g., a registration of the medical records of the pediatric department. The advantages of the chosen competencies include communicative skills as well as learning skills, or learning abilities. The range of skills in the area of interpersonal communication is comprehensive and very practically oriented. It should be emphasized that it also includes interactions with other specialists and health care staff members. Moreover, a universal value is also introducing the students into the life-long education - the ability and willingness to acquire new knowledge necessary for daily professional activities.

The fundamental question remains the model of the student clinical training – the prevalence of the general medicine versus the specialist education. This question should be addressed prior to any curriculum adjustments and modifications, thus, the starting point should be the model of the health care system in Kazakhstan and the planned scale of international cooperation with the European universities.

The detailed analysis of the syllabus is presented in the attachment 1A.3 – IV.

Surgery clinical training

These suggestions regarding the changes in the surgery training are a part of the plan to a 6-year long medical studies program initiates at the WKMOMU, which is typical for the majority of the European countries. The preliminary advise is to conduct the first two years of studies in the traditional form (as a subject-based course), then to systems-based courses in the subsequent three years, and finally, to plan the last - sixth year exclusively in hospitals and the outpatient clinics in order to introduce the medical students into the clinical practice. Surgery training course should be one of the most vital courses in the course of the four "clinical years" (3-6) of the medical studies.

The detailed suggestions regarding the surgical training include the following aspects:

1) First of all, it seems to be necessary to significantly increase the number of hours devoted for the surgery course – the total number of hours should be approximately twice higher during the last four years (3-6) of the studies.
2) It is worth considering whether to increase significantly the number of lecture hours delivered by the heads of departments, professors and the most experienced clinicians who can stimulate students' interest in surgery with the exciting practical aspects of this specialty.
3) Some of the topics (such as aseptics, antiseptics, infections, infestations or blood transfusions) should be covered during the preclinical courses (microbiology, parasitology, pathophysiology etc.) and not during the surgery course.
4) Some of the topics should be presented as separate courses (particularly orthopedics, anesthesiology, and otorhinolaryngology), and not be a part of the surgery course.
5) Some of the topics regarding the management of cancers should be presented during the oncology course, and only certain specific types of cancers (e.g. colorectal, endocrine, or lung cancers) – during the surgery course.
6) It is worth dividing the surgery course into surgical subspecialties – for instance:
    a. 3rd year – introduction to general surgery and traumatology
    b. 4th year – gastric/colorectal surgery, endocrine surgery, vascular surgery, urology
    c. 5th year – cardiac surgery, thoracic surgery, neurosurgery, pediatric surgery
7) A part of the surgery training (mainly lectures and seminars) should be based on systems-based courses, which integrate the elements learnt at the preclinical courses with clinical aspects of surgical diseases. Students must be prepared to these courses and their preclinical knowledge on anatomy, pathology, microbiology etc. should be evaluated before the surgery course starts.

8) Most of the practical classes (SSWT) during the 4th -5th years, and the entire 6th year must provide the opportunity to acquire some practical skills and competencies in any of the following patient-oriented approaches:
    a. bedside teaching – students have a chance to talk to patients, take their medical history, examine the patients and have access to the medical records under the supervision of an academic teacher. This form of practical classes can be conducted in the surgical departments, outpatient clinics, as well as in the emergency units.
    b. problem-based learning - students can receive some medical cases to be solved and learn from, guided by means of a group work with a teacher.
    c. shadowing in the operating theatre with presenting a real-life surgery with explanations given by an academic teacher. This form of practical classes can be substituted by the real-time TV coverage from the operating room to the seminar room.
9) It is crucial that all the SSWT (practical classes) hours should be performed in small groups (up to 6 students) under a constant supervision of an academic teacher.
10) The SSS hours should be devoted to the preparations for the seminars and practical classes with a teacher, which allows for discussing all problematic aspects and for applying the theoretical knowledge in practice. The SSS hours cannot replace a discussion with teacher.

The detailed analysis of the surgery clinical training has been presented in Attachment 1A3. – V.

The Principles of the General Practice (GP)

Information about the course referred to as the Principles of the General Practice was collected on the basis of the syllabus translated into English and provided by the WKMOMU and the questionnaire prepared by PUMS filled by the teacher. The Kazakh academics were asked to provide 1 hour of practical training via Skype, or other platform, for a separate session regarding the courses. Nevertheless, due to technical issues it was not possible.

The Principles of GP course takes five weeks - 480h. 30h of lectures, 80h of self-study under the guidance of a teacher, and 240h of students' self-study. The students spend four days per week, i.e., a total of 20 days in total students spend on practical training, and one day per week in the Practical Skills Centre.

The primary focus is on the family medicine practice. Students should be involved in the practical tasks with patients, as well as use and incorporate the knowledge and skills they have acquired during the medical studies up to that point. A General Practitioner working in the practice will act as a mentor and will combine teaching with treating patients in an outpatient

clinic during classes. Topics such as internal medicine, pediatrics, gynecology, and surgery will be covered. The subject depends on the cases, although the most important diseases should be presented to the students.

The training is divided into the theoretical aspects at the beginning of the day, lasting 1-2 hours, and the clinical part of 4-5 hours.

Students are expected to participate in discussions. They do not receive grades, therefore, they should not be afraid to ask, or attempt to answer the questions, even if they are unsure whether their answer is correct.

Group work provides a chance for discussion, questions, and a group searching for answers, which constitutes a more effective teaching model than lectures.

Students are expected to prepare for the classes, complete their homework during the week and study the topic discussed during the following group work session.

Students' self-study comprises a completion of two essays, five presentations, and reports.

On the day of the clinical practical training, students attend the outpatient clinic to meet the teacher for a class where they discuss the main clinical entities, solve cases, and practice communication skills, which takes about 2 hours. The teacher then assigns the students to the particular General Practitioners in the facility. The student works alongside the physician, follows doctor's routines, sees patients suffering from chronic diseases, fills in the paperwork, attends a patient call, and supervises pediatric patients. GP appointments last 5 hours a day, and the student is under his/her supervision during this entire time. A group comprises 12 students. The teachers are specialists in a given area of medicine – not specialists in family medicine.

Bedside teaching includes teaching in the presence of a patient. It is performed in groups of up to 6 students under a constant supervision of an academic teacher.

It can be conducted in hospitals as well as in the outpatient clinics.

Classification, pathophysiology, and diagnosis should be discussed in the course of other classes. Once a week for 6 hours, the student participates in the classes at the Practical Skills Centre with phantoms and "Botkin" interactive program under a teacher's guidance. Previously prepared cases are presented to the students. This is the time to acquire practical skills. During the course, students develop theory, practical skills, and interpersonal skills.

Comments

Looking at Poznan University of Medical Science (PUMS) experience, we would advise you to decrease the number of topics discussed during the course. There is no need to repeat what had been taught earlier. Some issues, such as congenital heart defects and glomerulonephritis do not have to be discussed during the family medicine classes. Epidemiology, pathophysiology, the definition of diseases had been covered earlier in the curriculum, therefore, there is no need to repeat them. There should be a clear distinction between the topics which are the subjects of students' self-study, and which issues are discussed during classes.

Students must learn the elements unique for family medicine – home visits, healthcare services provided to healthy people, e.g., vaccinations. During the classes, students should understand the management of the most common diseases present in the primary care. Students' groups during bedside teaching classes should be smaller - six students in one GP's office is far too many.

Self-study is not the most conducive method of learning family medicine. Writing two essays and reports is neither an efficient nor modern means of teaching medicine. Students should learn through exposure to real-life cases.

The syllabus should be more straightforward, containing a shorter list of subjects.

Core competencies the students should acquire following the completion of the course

1. The management of common conditions through the application and integration of the core medical knowledge (etiology, risk factors, pathophysiology, prevalence, clinical presentation, diagnostic evaluation, and interpretation) and the use of evidence-based decision-making in the primary care environment.
2. Initial management of acute conditions commonly observed in the primary care.
3. The management of chronic diseases common in the primary care.
4. Conduct a checkup appointment for a patient of any age.
5. Provide evidence-based health promotion and disease prevention.
6. Perform concise oral case presentations.

6th and 7th-year students' opinion on the General Practice course

Teaching quality evaluation is one of the measures to improve the planning and organization of the teaching process. Student teaching evaluations have had a long tradition and have been widely used within the European higher education framework.

The student evaluations have been shown to have direct impact on teaching quality by affecting changes that help to improve teaching, allowing staff to refine the way they teach and how they teach—improving the relationship between teachers and students. The results of the 6th and 7th year students' opinions are added to this "The improvement plan for the clinical training at the selected clinical facilities of the WKMOMU" as a helpful source of information regarding the students' expectations which should be taken into consideration in the process of modifying the clinical training at the WKMOMU.

A student evaluation survey of teaching activities has been developed, which is also conducted at PUMS. The survey is carried out in the following manner:

1. The survey is organized at the end of each course.

2. Evaluation reports combining data from all groups are available for the teaching staff in the intranet - WISUS
3. The Dean sends the evaluation reports to the course coordinators.
4. The course coordinators must identify the problems and develop solutions.
5. The results of the analysis are presented in a table," You said – We did."
6. The faculty committee on the quality of education verifies the analysis results.

At PUMS, different types of reports are used:
Closed-ended questions (handout + presentation).
Individual teacher Performance Report at the course level.
Open-ended questions report.
Individual Teacher Performance Report at the teacher level.
Course ranking report.
Up to date, there had been no surveys on the teaching quality performed at the WKMOMU. Only the skills and knowledge of students' are evaluated during their clinical classes.
During online meetings, we discussed the survey details. We chose which subject will be evaluated and which students will be asked for an opinion. Due to the pandemic, there were some difficulties in performing a large-scale student survey.
Finally, at the beginning of January 2021, as part of education quality assessment, we performed an online survey among the students. It was available since January 15th until February 5th. Students were asked to fill questionnaires collecting opinions about the course. Links (https://olat.ump.edu.pl) were sent to 806 students – 407 from the 6th year and 398 from the 7th year. Each student received an individual account, login was created using student's emails, and a password was: pumskz2021.
There were nine closed-ended questions – the statements about the course. The students were asked to rate the sentence according to the scale: from strongly disagree to strongly agree.
In the last question, students were asked to rate the course on the scale from 1 to 5.

The overall response rate was 81.24% - 85.74% (349/407 students from 6th year) and 76.63% (305/398 students from the 7th year).
The vast majority of students presented positive opinions towards the course. There were no statistically significant differences between students from 6th and 7th year.
Detailed results are presented in the tables.
The overall rating of the course was 4.11.
Opposing opinions were expressed by less than 7% of the respondents.
Around 75% of students had positive opinions about the course. Responses were similar in 6th and 7th year, although the students from the 7th year were slightly more critical.

Opposing opinions were expressed by less than 5.73% of the 6th year respondents.
The question with the highest percentage of negative responses was:
The classes facilitated the application of theory into practice - 5.7% expressed a negative opinion about this.

Two questions with the highest percentage of negative responses given by 7th year students were:
The classes facilitated the application of theory into practice. - 7.5% expressed a negative opinion about this.
The atmosphere motivates me as a learner. - 7.2% of the students did not agree with this statement.

Students' answers – the entire group n=654.

Total n=654	a) Strongly disagree	b) Disagree	c) Neither agree, nor disagree	d) Agree	e) Strongly agree
The assessment was fair.	10 1.53%	9 1.38%	52 7.95%	385 58.87%	105 16.05%
The atmosphere motivates me as a learner.	9 1.38%	25 3.82%	62 9.48%	365 55.81%	116 17.73%
The classes facilitated the application of theory into practice.	11 1.68%	32 4.89%	53 8.10%	353 53.97%	120 18.35%
Teachers provided me with helpful feedback which guided my further learning.	4 0.61%	22 3.36%	47 7.18%	367 56.12%	153 23.39%
I could personally perform tasks which will be a vital part of my future professional practice.	3 0.46%	6 0.92%	67 10.24%	370 56.57%	134 20.49%
The teachers demonstrated good communication skills and appropriate behavior	5 0.76%	14 2.14%	46 7.03%	368 56.27%	158 24.16%

towards patients.					
Management of emergencies applicable in a given area was emphasized.	7 1.07%	21 3.21%	77 11.77%	369 56.42%	113 17.28%
Teachers used up-to-date recommendations.	9 1.38%	17 2.59%	52 7.95%	370 56.57%	149 22.78%
The teaching content throughout the course was suitable for self-study.	4 0.61%	20 3.06%	40 6.11%	384 58.71	141 21.56%
Overall, I would rate this course on a 1-5 scale	1	2	3	4	5
	4 0.61%	6 0.92%	53 8.10%	171 26.15	366 55.96%

Students' answers – 6th year n= 349.

6th n=349	a) Strongly disagree	b) Disagree	c) Neither agree, nor disagree	d) Agree	e) Strongly agree
The assessment was fair.	6 1.71%	5 1.43%	24 6.87%	205 58.74%	54 15.47%
The atmosphere motivates me as a learner.	5 1.43%	7 2%	32 9.17%	198 56.73%	67 19.20%
The classes facilitated the application of theory into practice.	4 1.15%	16 4.58%	25 7.16%	201 57.59%	66 18.91%
Teachers provided me with helpful feedback which guided my further learning.	2 0.57%	8 2.29%	24 6.87%	201 57.59%	79 22.64%
I could personally perform tasks that will	2 0.57%	1 0.3%	37 10.6%	202 57.88%	70 20.06%

be a vital part of my future professional practice.					
The teachers demonstrated good communication skills and appropriate behavior towards patients.	2 0.57%	4 1.15%	23 6.59%	196 56.16%	85 24.35%
Management of emergencies applicable in a given area was emphasized.	3 0.86%	8 2.29%	35 10.03%	203 58.17%	69 19.77%
Teachers used up-to-date recommendations.	3 0.86%	10 2.86%	39 11.17%	305 87.39%	76 21.77%
The teaching content throughout the course was suitable for self-study.	3 0.86%	10 2.86%	22 6.30%	203 58.17%	71 20.34%
Overall, I would rate this course on a 1-5 scale	1	2	3	4	5
	1 0.3%	5 1.43%	23 6.59%	99 28.37%	188 53.87%

Students' answers – 7th year n=305.

7th n= 305	a) Strongly disagree	b) Disagree	c) Neither agree, nor disagree	d) Agree	e) Strongly agree
The assessment was fair.	4 1.31%	4 1.31%	28 9.18%	180 59.02%	51 16.72%
The atmosphere motivates me as a learner.	4 1.31%	18 5.95	30 9.84%	167 54.75%	49 16.06%

The classes facilitated the application of theory into practice.	7 2.29%	16 5.24%	28 9.18%	152 49.84%	54 17.70%
Teachers provided me with helpful feedback which guided my further learning.	2 0.65%	14 4.59%	23 7.54%	166 54.43%	74 24.26%
I could personally perform tasks that will be a vital part of my future professional practice.	1 0.33%	5 1.64%	30 9.84%	168 55.08%	64 20.98%
The teachers demonstrated good communication skills and appropriate behavior towards patients.	3 0.98%	10 3.28%	23 7.54%	172 56.39%	73 23.93%
Management of emergencies applicable in a given area was emphasized.	4 1.31%	13 4.26%	42 13.77%	166 54.43%	54 17.70%
Teachers used up-to-date recommendations.	6 1.97%	7 2.29%	13 4.26%	165 54.10%	73 23.93%
The teaching content throughout the course was relevant to self-study.	1 0.33%	10 3.28%	18 5.9%	181 59.34%	70 22.95%
Overall, I would rate this course on a 1-5 scale	1	2	3	4	5
	3 0.98%	1 0.33%	30 9.84%	72 23.6%	178 58.36%

Attachment 1A.3 - II

Principles of internal diseases – syllabus report

General remarks

1. Syllabi should be unified in the terms of construction (Table 1).
2. At the beginning of the syllabus, more basic information about the discipline/specialty should be provided (e.g., faculty, ye ar of study, coordinator)
3. Policy discipline and classes schedule could be added in an attachment.
4. In each syllabus science clubs cooperating with the Department of Internal Diseases could be given.
5.

Table. 1

Part of syllabus	Principles of internal diseases	Principles of internal diseases (undergraduate program)	Propaedeutics of internal diseases	Sections of internal diseases						
				Respiratory system	Cardio-vascular system	Digestive system	Diseases of the connective tissue	Diseases of hematopoietic organs	Urogenital system	Endocrine system
Information about teachers	✓	✓	✓	✓	X	✓	x	✓	✓	✓
Contact information	✓	✓	✓	✓	X	✓	x	✓	✓	✓

Discipline policy	✓	✓	✓	✓	X	✓	x	✓	✓	✓
Introduction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Purpose of the discipline	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Learning Outcomes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Prerequisites and post-requisites	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Plan of studies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
The subject content plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Criteria and regulations of knowledge evaluation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
References (basic and additional)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Detailed remarks

1. Principles of internal diseases

- The construction of the syllabus is legible (it could be considered a model for other syllabi).
- Teaching methods are appropriate.
- Learning Outcomes could be supplemented with regard to certain skills: follow the rules of professional ethics; prioritize the welfare of and show respect for patients and the social groups.
- The subject content could be supplemented regarding certain issues: hypothalamus and pituitary gland diseases, adrenal glands diseases, diagnosis of jaundice, disorders of calcium and phosphate metabolism, Hodgkin and non-Hodgkin lymphomas.
- Criteria and regulations of knowledge evaluation are appropriate.
- Basic and additional references could be expanded.

2. Principles of internal diseases (undergraduate program)

- The syllabus "Principles of internal diseases (undergraduate program) is similar in its scope to the "Fundamentals of internal diseases" mentioned above. Slight differences can be seen in "discipline policy" and references (there are more items in this section), whereas the "learning outcomes" and "the subject content" are almost the same. Thus, the additions to this syllabus have been provided above.

3. Propaedeutics of internal diseases

- The syllabus may be improved in terms of construction (i.e. discipline policy and organization of educational process could be presented in the form of table – such a version would be easier for students).
- The syllabus seems to be appropriate in terms of learning outcomes and the subject content. It is an introduction to "Principles of internal diseases".

4. Respiratory system

- Information about teachers and discipline policy could be presented in a table.

- "The results of training" instead of "educational outcomes" could be supplemented in the scope of "Knowledge and understanding", e.g., know the environmental and epidemiological conditions of the most common respiratory diseases; know the detailed organs pathology, macro- and microscopic images and the clinical course of pathomorphological changes in respiratory system.
- The subject content could be supplemented with regard to certain issues: hemoglobin, the participation of hemoglobin in the transport of oxygen and carbon dioxide, the body's adaptation mechanisms to the conditions of hypoxia and reduced oxygen pressure (high altitude); mechanism of carbon dioxide (CO_2) poisoning.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are very extensive.

5. Cardiovascular system

- Information about teacher, contact and discipline policy should be added.
- "Learning outcomes" instead of "educational outcomes" could be completed in the area of " Knowledge and understanding", e.g., know the activity and mechanisms of regulation of every organs and systems in the human body, including cardiovascular system and the area of "Learning Skills or Learning Abilities", e.g., is aware of his own limitations and knows when to refer to other professionals.
- The subject content could be supplemented with regard to certain issues: pathophysiology and pathomorphology of the heart, resting and functional potential of heart cells.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are very extensive.

6. Digestive system

- Information about teachers and discipline policy could be presented in a table.
- "The end results of training" instead of "educational outcomes" could be completed in the area of "Knowledge and understanding", e.g., know the environmental and epidemiological conditions of the most common digestive diseases.
- The subject content could be supplemented with regard to certain issues: malabsorption syndrome, inflammatory bowel diseases.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are very extensive.

7. Diseases of connective tissue

- Information about teacher, contact and discipline policy should be added.
- "The end results of training" instead of "educational outcomes" could be completed in the area of "Communicative ability" and "Learning skills or learning ability" according to other syllabi regarding the Internal diseases.
- Syllabus seems to be appropriate in terms of the subject content.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are very extensive.

8. Diseases of hematopoietic organs

- Information about teachers and discipline policy could be presented in a table.
- "The end results of training" instead of "educational outcomes" seems to be appropriate.
- The subject content could be supplemented with regard to the information concerning Hodgkin and non-Hodgkin lymphomas.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are extensive.

9. Urogenital system

- Information about teachers and discipline policy could be presented in a table.
- "The end results of training" instead of "educational outcomes" seems to be appropriate.
- Syllabus seems to be appropriate in terms of the subject content.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are extensive.

10. Endocrine systems

- Information about teachers and discipline policy could be presented in the table.
- "Learning outcomes" instead of "educational outcomes" seems to be appropriate.

- The subject content could be supplemented with regard to the information concerning diabetes, e.g., insulin preparations, pens, glucometers, insulin pumps; bloodless glucose concentration monitoring systems; selected clinical problems in diabetic patients, including psychological aspects.
- Criteria and regulations of knowledge evaluation are appropriate.
- References are extensive.

Attachment 1A.3 – III

Analysis of Pediatrics

1. Propaedeutics of children's diseases

The analysis was based on the syllabus of the Propedeutics of children's diseases (Discipline Code PDB 3217, specialty: 5B130100 "General medicine") approved by the Vice-Rector for Educational Affairs on 29th August 2018.

The purpose of this course is the formation of modern scientific views and knowledge regarding the anatomical and physiological characteristics of the child's body, the semiotics of organ and systems, rational child nutrition, methods of examination of children at a different age, necessary for training and the subsequent practice of the doctor.

The learning outcomes are presented in Table 1.

Table 1: Learning outcomes

Formed competence	The training outcomes in the discipline
Knowledge and understanding	- anatomical and physiological features of organs and systems in children of different ages - principles of physical development in children - stages of neuropsychiatric development of a child due to the age characteristics of the Central Nervous System - examination methods of organs and systems - principles of rational child nutrition in the first year of life and nutrition of the older children - physiological constants of individual organs and systems (laboratory, functional, etc.) - semiotics and disorders of organs and systems in various diseases in children

Knowledge application and understanding	- interview ill children and their relatives - assess the level of physical development - assess the level of neuropsychological development of a child - to examine and assess the condition of organs and body systems (skin, musculoskeletal, respiratory, cardiovascular, digestive, endocrine, urinary system) - to identify clinical symptoms and conduct a post-syndrome diagnosis - analyze the results of clinical, laboratory, functional, instrumental examinations methods - calculate nutrition and prepare a diet for healthy children within the first year of life, who are breast-, formula, or mixed fed
Opinion formation	- the ability to select and evaluate the information obtained during anamnesis, clinical, and laboratory /instrumental examinations of the patient
Communicative skills	- to advise the patient, his / her parents in the establishment of effective long-term relationships, without prejudice to their right to independence and autonomy - to be able to provide information in a way that is understandable to the patient and his / her parents, explaining the essence of the proposed treatment and test results - to be able to adequately respond to the different emotions of the patient, his / her parents; - to be able to interact with other employees and specialists, including those

	working in the primary health care system, and if necessary - to protect the patient's rights.

Comments: The learning outcomes presented above have been well described in four parts. The elements of "Knowledge application and understanding" and "Opinion formation" have been added to "Knowledge and understanding". The vital part - Communication skills have been presented separately. The specific outcomes have been listed in bullet points and contain all the necessary elements. A particular shortcoming is a weak emphasis on the subject of a healthy child. However, this may be included in the anatomical and physiological characteristics of children at different ages. Issues of semiotics and child study are covered sufficiently and in detail. Communication skills covering all relevant areas, i.e., communication with patients and their parents, managing emotions, working in a team, including specialists of the primary health care, have been well and widely included. The need to protect patients' rights has also been highlighted. Summarizing, the learning outcomes are well prepared and need only some minor corrections.

The distribution of teaching hours is presented in Table 2.

Table 2: The distribution of teaching hours.

Discipline	Number of credits	Hours	Including			Form of assessment
			PL	SSS	SSWT	
Propedeutics of children's diseases	3	135	7/38	45	45	Exam: test assessment

Explanation of abbreviations: PC – practical classes / practicals; SSS – Student Self-study; SIWT – Student Self-study under a tutor's supervision.

A total number of teaching hours is 135, including 7 hours of lectures. 5 out of these 7 hours are dedicated to syndromes of different organs and systemic diseases; one is focused on the childhood period, and one on rational child nutrition.

Practical classes are provided without the patient's participation. The students work in small groups together with the teacher. These classes' subject matter is mostly devoted to anatomy and physiology of the child (16 hours), but also to history taking and medical examination (14 hours), and to child nutrition issues (6 hours). This part of the course emphasizes

the child's anatomical and physiological distinctiveness with a marginal consideration of a healthy child's problems, health promotion, and prevention in Pediatrics. These subjects are more engaging for students, and more useful in the future doctor's practice.

The crucial part of this clinical training is the Student Self-study under a tutor's supervision. With 45 hours of the clinical training, this part is conducted in a hospital ward, at the patient's bedside and focuses on studying the physical examination. Due to the emphasis on students mastering the practical skills of children examination, this part of the training can be considered the most valuable.

A particular part of the clinical training is the Student Self-study with the duration of 45 hours. Students read the assigned material and prepare summaries and presentations. The duration of this part of clinical training is quite extensive and probably not very appealing for students. Significant modification of this part of the clinical training, both in terms of the number of hours and selected teaching methods, should be discussed among the academic teachers and students. The topics in this part of clinical training are focused on issues of child physiology. If this part of the course was to remain as part of Self-study, the topics should be modified in order to solve certain prepared clinical problems of a healthy child, e.g., developing feeding schedules for a particular child, development evaluation of children described in given cases, or preparing vaccination schedules.

The criteria and regulations for knowledge evaluation include all learning objectives - knowledge, skills, and competencies.

Conclusions: The presented Syllabus of "Propedeutics of children's diseases" contains well-described learning outcomes, including all the essential elements. A particular shortcoming is a weak emphasis on the subject of a healthy child. Issues of semiotics and child examination are covered sufficiently and in detail. Additionally, the communication skills cover all the relevant areas of the clinical teaching in the scope of pediatrics. The learning outcomes are well described and require only minor corrections.

In practical classes, in which students work in small groups together with the teacher, the main emphasis is on the child's anatomy and physiology. Nevertheless, the issues of a healthy child, health promotion, and prevention in Pediatrics seem to be addressed insufficiently. It should be considered to choose these practical issues which are more appealing to students and more useful in the daily doctor's practice.

The Student Self-study requires certain modifications in terms of duration, the selected topics, and teaching methods. In the current curriculum, the issues of this part of the clinical training are focused on child physiology. If this part of the course was to remain as part of Self-study, the topics should be modified in order to solve some prepared clinical problems of a

healthy child, e.g., developing feeding schedules for a particular child, development evaluation of children described in given cases, or designing vaccination schedules.

Attachment 1A.3 – IV

Analysis of Pediatrics

2. Principles of children's diseases

The analysis was based on the syllabus of "Principles of children's diseases (Discipline Code ODB 4305, specialty: 5B130100 "General medicine") approved by the Vice-Rector for Educational Affairs on 29th August 2018.

The purpose of this course is to prepare an undergraduate program in Pediatrics, aimed at providing diagnostic and therapeutic care for the most common childhood diseases in their typical manifestations following the principles of the evidence-based medicine, as well as modern achievements of medical and diagnostic technologies.

The main difference between the presented program of teaching the Principles of children's diseases and the programs in the European universities is that the analyzed program aims to train an undergraduate–specialist in pediatrics. In the typical European university programs, the aim is to provide the necessary knowledge in pediatrics to students prepared for their future role as General practitioners. This fundamental difference affects the number of teaching hours and the scope of the material covered. An obvious consequence of pre-graduate specialty training is a more significant proportion of specialist knowledge less useful to the family physician.

The learning outcomes are presented in Table 1.

Table 1: Final results of the training.

Formed competence	The final training results in the discipline
Knowledge and understanding	- safety at work in health care facilities - features of work of all clinical and paraclinical divisions of a children's hospital - medical records of pediatric departments, its purpose and management - the main modern clinical, laboratory, and instrumental methods of research, principles of treatment and prevention of the most common diseases in children
Applying knowledge and understanding	- medical history of a child patient or caring for them - physical examination of an ill child - assessment of the physical development of a child

	- determination of the type and volume of clinical, laboratory, and instrumental methods of research in the most common childhood diseases - to justify and formulate a preliminary diagnosis - to justify and formulate the final diagnosis - preparation of a treatment plan for the most common childhood diseases - registration of the medical records of a pediatric department
Opinion formation	- the ability to select and evaluate the information obtained in the course of anamnesis, clinical and laboratory/instrumental examination of the patient; the ability to use the information in the preparation of a treatment plan, clinical examination plan, rehabilitation with the participation of the patient; - ability to make decisions in emergencies; - the ability to diagnose at the initial stages of the disease; relevance and effectiveness of diagnostic and therapeutic interventions;
Communicative skills	- to advise the patient, his / her parents in the establishment of effective long-term relationships, without prejudice to their right to independence and autonomy; - to be able to provide information in a way that is understandable to the patient and his / her parents, explaining the essence of the proposed treatment and test results - to be able to adequately respond to the different emotions of the patient, his / her parents; - to be able to interact with other employees and specialists, including those working in the primary health care system, and if necessary, to protect the patient's rights.
Learning skills or learning abilities	- ability and willingness to acquire new knowledge necessary for daily professional activities and continuing education,

	- to have the ability to combine knowledge and skills to provide an individualized approach to treating a particular patient.

Comments: The Final results of the training have been described in detail in five parts. In the first one, entitled "Knowing and understanding", the main emphasis is on preparing the student to work in the clinical and paraclinical units of a children's hospital, including medical records of pediatric departments, its purpose, and management. This description shows that the primary goal of the clinical training in pediatrics is to prepare the specialist to work in a hospital environment. This teaching direction in pediatrics is different from the solutions adopted at the European universities. The main objective is to prepare a family doctor who can also provide a day-to-day care for children in the outpatient conditions. This field of education requires more emphasis on the issues of a healthy child, health promotion and disease prevention. At the same time, there is a lack of in-depth training relevant for working in specialist hospitals. These differences probably stem from the tradition of training physicians in Kazakhstan and from a different model of health care. However, they may constitute a significant obstacle in the cooperation between the Kazakh's and Europeans Universities in the medical education. For most European students, the principles of children's diseases are too broad and too specialized. Furthermore, these differences are also visible in the second part of the formed competencies - "Applying knowledge and understanding". Additionally, some specific competencies combined with the child development and a child's examination have also been mentioned, e.g., registration of medical records of the pediatric department. The advantages of the chosen competencies are the communicative skills and the learning skills, or learning abilities. In fact, the range of skills in the area of interpersonal communication is broad, and it includes such elements as providing information to the patients and their parents, responding to the various emotions of patients and their relatives, and interacting with other specialists involved in this particular area of patient care.

The most essential elements are learning skills described as the ability and willingness to acquire new knowledge necessary for daily professional activities, as well as the ability to apply modern medical research achievements in the individual approach in the treatment of a particular patient.

Summarizing, the crucial decision is to choose between an undergraduate-specialist education in pediatrics and a General Practitioner. If the second option is chosen, the described formed competencies should be modified.

The distribution of teaching hours is presented in Table 2.

Table 2: The distribution of teaching hours .

Discipline	Number of credits	Hours	Including			Form of assessment
			PC	SSS	SSWT	
Principles of children diseases	5	225	12/63	75	75	Exam: 1st stage – assessment test 2nd – OSCE - practical skills assessment

Explanation of abbreviations: PC – practical classes / practicals; SIW – Student Self-study; SIWT – Student Self-study under a tutor's supervision; OSCE – Objective Structured Clinical Examination

A total number of teaching hours is 225 including 12 hours of lectures. The lectures are mainly devoted to the diagnostics, treatment, and prevention of the diseases of different organs analyzed on the basis of evidence-based medicine.

Practical classes are provided without the participation of patients. The students work in small groups together with the teacher. These classes comprise 23 detailed topics delivered over 63 hours. Among the topics, apart from certain fundamental issues, there are also some very specialist ones. During these classes, the student is introduced to a wide range of pediatrics beyond the requirements specified for a family physician.

The most important part of this clinical training is the Student Self-study under a tutor's supervision. This portion of the pediatrics course includes 75 hours devoted to pediatric subspecialties, ranging from rheumatology through gastroenterology, nephrology, pulmonology, to hematology. An indispensable component of this part of the clinical training is the analysis of prepared the clinical cases illustrating particular diseases, both as a group and with the teacher. This part of the clinical training provides the student with a unique opportunity to analyze more common and more complicated cases with the tutor's guidelines.

A more traditional part of the clinical training is the Student Self-study, which includes preparing four abstracts on the assigned topics. This part also includes 10 hours of child supervision with an assessment of physical, neuropsychic, and sexual development, conversation with a mother or a caregiver on the organization of the regimen, care, as well as feeding the child. This part of the clinical training is focused rather on the practical aspects than on the Propedeutics of children's diseases.

Credit for the course is awarded on the basis of a two-stage examination.. The first part consists of an assessment test. The second one is The Objective Structured Clinical Examination, which is currently the most popular method of evaluating the knowledge and practical skills of a student in most clinical disciplines.

Conclusions: The presented Syllabus of The Principles of Children's Diseases constitutes a valuable document, which was prepared for the clinical training of future specialists in pediatrics, rather than instead of General Practitioners. The content of this course is too broad and too specialized. In addition, some typical competencies combined with the child development and child examination have also been listed, e.g., a registration of the medical records of pediatric department. The advantages of the chosen competencies include communicative skills, as well as the learning skills, or learning abilities. The range of skills in the area of interpersonal communication is comprehensive and very practically oriented. It should be emphasized that it also includes interactions with other specialists and health care staff members. Moreover, a universal value is also introducing the students into the life-long education- the ability and willingness to acquire new knowledge necessary for daily professional activities.

The fundamental question remains the model of the student clinical training – the prevalence of the general medicine versus the specialist education. This question should be addressed prior to any curriculum adjustments and modifications, thus, the starting point should be the model of the health care system in Kazakhstan and the planned scale of international cooperation with the European universities.

Attachment 1A.3 – V

The improvement plan of the surgery course at the West Kazakhstan Marat Ospanow Medical University (WKMOMU) in Aktobe

Introduction

Poznań University of Medical Sciences (PUMS) experience shows that despite the progress in medicine and many changes in models, types and methods of learning, surgery – together with internal diseases, pediatrics and gynecology - remains one of the four most important clinical courses.

The surgery course provides knowledge necessary for every medical doctor, as well as basic practical skills and competencies helpful in every medical specialty (not only surgical). Therefore, the number of hours devoted to the surgery training during the medical studies remains very high with a special emphasis on the direct contact between students, patients and teachers, and on learning practical skills.

The following suggestions are based on the comparative analysis of data regarding the surgery courses present in syllabi and questionnaires for the academic teachers, as well as visits to the university departments in hospitals during our previous stays in Aktobe.

A comparison of the surgery courses at PUMS and WKMOMU

The following table shows a direct comparison of the hours devoted to the surgery training

Semester (year)	**PUMS**				**WKMOMU**			
	Total	L/PC	SSWT	SSS	Total	L/PC	SSWT	SSS
5-6 (III)	85	20 + 20	20	25	90	10 + 20	30	30
7-8 (IV) Pediatric	150	30 + 30	60	30	180 45	6 + 54 0 + 15	60 15	60 15
9-10 (V) pediatric	128 52	24 + 24 6 + 6	32 18	48 22	---	---	---	---
11-12 (VI)	240	---	120	120	---	---	---	---
TOTAL	**655**	80 + 80	250	245	**315**	16 + 89	105	105

L – lectures, PC – practical classes / practicals (large group seminars), SSWT – student self-study with a teacher at the clinical facility (practical classes), SSS – student self-study at home

It is worth noting that the total number of hours devoted to surgery training is more than twice lower at the WKMOMU (315) than at PUMS (655), and the number of lectures is five times lower at the WKMOMU (16) as compared to PUMS (80).
The number of students per one teacher during the SSWT hours is 7-9 at the WKMOMU and 5-6 at PUMS.
It is also vital to mention that all the PUMS students spend all the SSS time preparing to the seminars (LP) and practical classes (SSWT) with a teacher. The number of SSS hours increases accordingly with the consecutive years. However, it seems that the WKMOMU students spend the SSS hours to elaborate and study certain topics which are not further discussed with a teacher, although this knowledge is necessary to pass the final exam.

Suggestions of changes in the surgery training

Our suggestions regarding the changes in the surgery training are a part of the plan to initiate a 6-year long medical studies program at the WKMOMU, which is typical for the majority of European countries. We would advise you to conduct the first two years of studies in the traditional formula (a subject-based course), then to include the systems-based courses in the subsequent three years, and finally, to plan the last - sixth year exclusively in hospitals and the outpatient clinics in order to introduce the medical students into the clinical practice. Surgery training course should be one of the most vital courses in the course of the four "clinical years" (3-6) of the medical studies.
The detailed suggestions regarding the surgery training include the following aspects:

1) First of all, it seems to be necessary to significantly increase the number of hours devoted for the surgery course – the total number of hours should be approximately twice higher during the last four years (3-6) of the studies.
2) It is worth considering whether to increase significantly the number of lecture hours delivered by the heads of departments, professors and the most experienced clinicians who can stimulate students' interest in surgery with the exciting practical aspects of this specialty.
3) Some of the topics (such as aseptic, antiseptics, infections, infestations or blood transfusions) should be covered during the preclinical courses (microbiology, parasitology, pathophysiology etc.) and not during the surgery course.
4) Some of the topics should be presented as separate courses (particularly orthopedics, anesthesiology, and otorhinolaryngology) and not be a part of the surgery course.
5) Some of the topics regarding the management of cancers should be presented during the oncology course and only certain specific types of cancers (e.g. colorectal, endocrine or lung cancers) – during surgery course.

6) It is worth dividing the surgery course into surgical subspecialties – for instance:
    a. 3rd year – introduction to general surgery and traumatology
    b. 4th year – gastric/colorectal surgery, endocrine surgery, vascular surgery, urology
    c. 5th year – cardiac surgery, thoracic surgery, neurosurgery, pediatric surgery
7) A part of the surgery training (mainly lectures and seminars) should be based on systems-based courses, which integrate the elements learnt at the preclinical courses with clinical aspects of surgical diseases. Students must be prepared to these courses and their preclinical knowledge on anatomy, pathology, microbiology etc. should be evaluated before the surgery course starts.
8) Most of the practical classes (SSWT) during the 4th -5th years, and the entire 6th year must provide the opportunity to acquire some practical skills and competencies in any of the following patient-oriented approaches:
    a. bedside teaching – students have ability chance to talk to patients, take their medical history, examine the patients and have access to the medical records under the supervision of an academic teacher. This form of practical classes can be conducted in the surgical departments, outpatient clinics, as well as in the emergency units.
    b. problem-based learning - students can receive some medical cases to be solved and learn from, guided by means of a group work with a teacher.
    c. shadowing in the operating theatre with presenting a real-life surgery with explanations given by an academic teacher. This form of practical classes can be substituted by the real-time TV coverage from the operating room to the seminar room.
9) It is extremely important that all the SSWT (practical classes) hours should be performed in small groups (up to 6 students) under a constant supervision of an academic teacher.
10) The SSS hours should be devoted to the preparations for the seminars and practical classes with a teacher, which allows for discussing all problematic aspects and for applying the theoretical knowledge in practice. The SSS hours cannot replace a discussion with a teacher.

We hope that most of the abovementioned suggestions will be possible to accept and implement to the curriculum of the medical studies at the WKMOMU in Aktobe.

Attachment 1A.3 – VI

The Principles of the General Practice - the analysis of the syllabus and clinical training

Information about the course referred to as the Principles of the General Practice was collected on the basis of the syllabus translated into English and provided by WKMOMU and the questionnaire prepared by PUMS completed by the teachers. The Kazakh academics were asked to provide 1 hour of practical training via Skype or other platform for a separate session regarding the courses. Nevertheless, it was not possible due to technical issues.

The Principles of the GP course takes five weeks, i.e. 480 h, including 30 h of lectures, 80 h of self-study under a tutor's supervision, and 240 h of students' self-study. Students spend 4 days a week, i.e., a total of 20 days, in practical training, and one day per week in the Practical Skills Centre.

The primary focus is on the family medicine practice. Students should be involved in the practical tasks with patients, as well as use and incorporate the knowledge and skills they have acquired during the medical studies up to that point. A General Practitioner working in the practice act a a mentor and will combine teaching with treating patients in an outpatient clinic during classes. Topics, such as internal medicine, pediatrics, gynecology, and surgery will be covered. The subject depends on the cases, although the most important diseases should be presented to the students. The training is divided into the theoretical aspects at the beginning of the day, lasting 1-2 hours, and the clinical part of 4-5 hours.

Students are expected to participate in discussions. They do not receive grades, the refore, they should not be afraid to ask or attempt to answer the questions, even if they are unsure whether their answer is correct.

Group work provides a chance for discussion, questions, and a group searching for answers, which constitutes a more effective teaching model than lectures.

Students are expected to prepare for the classes, complete their homework during the week and study the topic discussed during the following group work session. Students' self-study comprises a completion of two essays, five presentations, and reports.

On the day of the clinical practical training, students attend the outpatient clinic to meet the teacher for a class where they discuss the main clinical entities, solve cases, and practice communication skills, which takes about 2 hours. The teacher then assigns the students to the

particular General Practitioners in the facility. The student works alongside the physician, follows doctor's routines, sees patients suffering from chronic diseases, fills in the paperwork, attends a patient call, and supervises pediatric patients. GP appointments last 5 hours a day, and the student is under his/her supervision during this entire time. A group comprises 12 students. The teachers are specialists in a given area of medicine – not specialists in family medicine.
Bedside teaching includes teaching in the presence of a patient. It is performed in groups of up to 6 students under a constant supervision of an academic teacher. It can be conducted in hospitals as well as in the outpatient clinics.

Classification, pathophysiology, and diagnosis should be discussed in the course of other classes.
Once a week for 6 hours, the student participates in the classes at the Practical Skills Centre with phantoms and "Botkin" interactive program under a teacher's guidance. Previously prepared cases are presented to the students. This is the time to acquire practical skills. During the course, students develop theory, practical skills, and interpersonal skills.

Comments

Looking at Poznan University of Medical Science (PUMS) experience, we would advise you to decrease the number of topics discussed during the course. There is no need to repeat what had been taught earlier. Some issues, such as congenital heart defects and glomerulonephritis do not have to be discussed during the family medicine classes. Epidemiology, pathophysiology, the definition of diseases had been covered earlier in the curriculum, therefore, there is no need to repeat them. There should be a clear distinction between the topics which are the subjects of students' self-study, and which issues are discussed during classes.

Students must learn is the elements unique for family medicine – home visits, healthcare services provided to healthy people, e.g., vaccinations. During the classes, students should understand the management of the most common diseases present in the primary care. Students' groups during bedside teaching classes should be smaller - six students in one GP's office is far too many.

Self-study is not the most conducive method of learning family medicine. Writing two essays and reports is neither an efficient nor modern means of teaching medicine. Students should learn through exposure to real-life cases.
The syllabus should be more straightforward, containing a shorter list of subjects.

Core competencies the students should acquire following the completion of the course

1. The management of common conditions through the application and integration of the core medical knowledge (etiology, risk factors, pathophysiology, prevalence, clinical presentation, diagnostic evaluation, and interpretation) and the use of evidence-based decision-making in the primary care environment.

2. Initial management of acute conditions commonly observed in the primary care.
3. The management of chronic diseases common in the primary care.
4. Conduct a checkup appointment for a patient of any age.
5. Provide evidence-based health promotion and disease prevention.
6. Perform concise oral case presentations.

Suggested modifications in the syllabus

№	Topics of classes Basic issues in accordance with the topic	Knowledge Skills Habits		Hours
		Internal diseases in the GP practice		
1	PC. Acute coronary syndrome in the GP practice.	~~- Atherosclerosis. Stenocardia. Myocardial infarction. Epidemiology. Classification.~~ Screening. Risk factors. - Cardiovascular prevention in the GP practice ~~- carrying out differential diagnosis based on clinical cases discussed;~~ - making diagnosis and planning the treatment – particularly in outpatient care - according to the recommendations of the scientific societies; - laboratory tests interpretation and understanding the causes for the deviations; - outpatient management before and after discharging a patient from the hospital. Dynamic observation. The issue of medical labor examination. Prognosis following myocardial infarction. Indications for hospitalization. Sanatorium and health resort treatment. Rehabilitation program. Prevention. - ECG registration and reading		3

2	Hypertension in the GP practice.	~~Epidemiology. Classification. Stratification of the general cardiovascular risk.~~ Screening. Algorithm of diagnostic management in the outpatient conditions. Outpatient management strategy. ~~taking into account the peculiarities of the pregnancy course in the elderly women, and with the presence of comorbidities.~~ Indications for hospitalization ~~in the hospital, in the day hospital.~~ Blood pressure measurement (BP). The basic principles of patient care training. Dynamic observation. The issue of medical labor examination. Rehabilitation program. Sanatorium and health resort treatment. Prevention.	CBL	3
3	Rhythm disorders in the GP practice.	~~Types of arrhythmias. Main reasons.~~ Clinical and ECG signs of extrasystoles arrhythmias. Conduction disorders. Algorithm of diagnostic search in ambulatory conditions. Outpatient management strategy., ~~taking into account the peculiarities of the pregnancy course in the elderly women, and with the presence of comorbidities.~~ Indications for hospitalization ~~in the hospital, in the day hospital~~. The issue of medical labor examination. Rehabilitation program. Dynamic observation.	CBL	2
4	Circulatory failure in the GP practice.	~~Circulatory failure definition. Risk factors. Diagnostics. Principles of non-drug and drug correction in the outpatient setting. Prevention.~~ Chronic heart failure. ~~Epidemiology.~~ Screening. ~~Classification.~~ Outpatient diagnosis. Outpatient management strategy. Indications for hospitalization ~~in the hospital, in the day hospital~~. Dynamic observation. The issue of medical labor examination. Prevention.	Interactive	2

5	Pneumonia in the GP practice.	~~Epidemiology. Etiology.~~ Classification. Diagnostics. Outpatient management strategy. Management of mild pneumonia in patients older than 60 years. ~~or related diseases. Features of the management of sick children, adolescents, elderly.~~ Indications for hospitalization ~~in the hospital, in the day hospital~~. Dynamic observation. The issue of medical labor examination. Rehabilitation program. Sanatorium and health resort treatment. Prevention.	Interactive	2
6	Bronchial obstruction syndrome in the GP practice	Acute and chronic bronchitis. COPD. Bronchial asthma. Basic principles of international programs (GOLD, GINA). ~~Features of the management of sick children, adolescents, elderly.~~ Dynamic observation. The issue of medical labor examination. Rehabilitation program. Sanatorium and health resort treatment. Prevention.	CBL	3
7	Respiratory failure in the GP practice. Chronic pulmonary heart	~~Classification, clinical manifestations, modern approaches to therapy.~~ Management strategy on a pre-hospital stage. ~~Epidemiology. Classification.~~ Screening. Risk factors. ~~Diagnostics~~. Management strategy in the outpatient conditions. Indications for hospitalization. ~~in the hospital, in the day hospital.~~ Dynamic observation. The issue of medical labor examination. Prevention.	CBL	2

8	Urinary system diseases in the GP practice	Acute and chronic pyelonephritis, glomerulonephritis. ICD. ~~Epidemiology. Classification.~~ Screening. Risk factors. ~~Diagnostics.~~ Management strategy in the outpatient environment. Management of ill children, adolescents, elderly. Indications for hospitalization in the hospital, in the day surgery unit. Prevention. ~~Acute and chronic glomerulonephritis. Epidemiology. Screening. Classification. Risk factors. Diagnostics. Management in out-patient conditions. Indications for hospitalization. Dynamic observation. Questions of medical labor examination. Prevention. – ESRD, Epidemiology. Screening.~~	Interactive	3
9	Gastric dyspepsia in the GP practice.	GERD. HP - associated conditions: gastritis, peptic ulcer. ~~Epidemiology.~~ Screening. ~~Classification~~. Risk factors. ~~Diagnostics.~~ Management of ill children, adolescents, elderly. Outpatient treatment. Indications for hospitalization in the hospital, in the day surgery unit. Dynamic observation. The issue of medical labor examination. Prevention.	Interactive	3
10	Intestinal dyspepsia in the GP practice.	Irritable bowel syndrome. ~~Epidemiology.~~ Screening. ~~Classification. Risk factors.~~ Diagnostics. Outpatient treatment. Management of ill children, adolescents, elderly. Indications for hospitalization in the hospital, in the day surgery unit. The issue of medical labor examination. Dynamic observation. Prevention.	CBL	2

11	Pancreatic and biliary tract diseases in the GP practice.	Pancreatitis, cholecystitis, biliary dyskinesia. ~~Epidemiology.~~ Screening. ~~Classification~~. Risk factors. Diagnostics. Management of ill children, adolescents, elderly. Outpatient treatment.. Indications for hospitalization ~~in the hospital, in the day hospital.~~ Dynamic observation. The issue of medical labor examination. Prevention.	Interactive	2
12	Liver damage in the GP practice.	Hepatitis, cirrhosis of the liver. Epidemiology. Screening. Classification. Risk factors. Diagnostics. Outpatient treatment. Indications for hospitalization in the hospital, in the day surgery unit. Dynamic observation. The issue of medical labor examination. Prevention.	Interactive	3
13	Anemic syndrome in the GP practice.	Iron deficiency anemia, ~~B-12 deficient, hypo-aplastic anemia. Epidemiology. Screening. Classification.~~ Risk factors. Diagnostics. Outpatient treatment. Indications for hospitalization in the hospital, or in the day surgery unit. Dynamic observation. The issue of medical labor examination. Prevention. Acute and chronic leukemia. Epidemiology. Classification, clinical manifestations. Modern methods of diagnosis. Outpatient treatment. Dynamic observation. The issue of medical labor examination.	PBL	3
14	Acute rheumatic fever, CRD, heart defects in the GP practice. Heart defects.	Heart defects. Epidemiology. Classification. Hemodynamics of heart defects. Risk factors. Diagnostics. Management of ill children, adolescents, people of elder age. Outpatient treatment. Indications for hospitalization. Dynamic observation. The issue of medical labor examination. Training the patient. Prevention.	CBL	3

15	Articular syndrome in the GP practice. Osteoporosis. Dysfunctions of the joints.	Osteoporosis, dysfunction of the joints. Rheumatoid arthritis. Osteoarthritis, reactive arthritis, gout. ~~Epidemiology. Classification. Risk factors.~~ Risk factors and screening for osteoporosis. Diagnostics. ~~Features of the management of sick children, adolescents, people of elderly age.~~ Outpatient treatment. Dynamic observation. The issue of medical labor examination. Indications for hospitalization in the hospital, in the day surgery unit. Training the patient. Prevention.	CBL	3
16	Diabetes in the GP practice.	~~Epidemiology.~~ Screening. ~~Classification.~~ Risk factors. Diagnostics. Management of ill children, adolescents, people of elderly age. Outpatient treatment. Indications for hospitalization in the hospital, in the day surgery unit. Dynamic observation. The issue of medical labor examination. Training the patient. Prevention.	CBL	3
17	Thyroid diseases in the GP practice.	Hypothyroidism, hyperthyroidism. Epidemiology. Classification. Risk factors. Screening. Diagnostics. Outpatient treatment. Indications for hospitalization in the hospital, in the day surgery unit. Dynamic observation. The issue of medical labor examination. Training the patient. Prevention.	Standardized pateint	3
18	Metabolic syndrome and obesity in the GP practice.	~~Epidemiology. Classification, clinical manifestations.~~ Body mass index. Principles of non-drug and drug therapy. Dynamic observation. Patient education.	CBL	2
	Total			46
	Midterm 1			
		Children's diseases in the GP practice		

1	Principles of healthy children clinical examination.. Children's health assessment. Puberty development assessment.	Organization of pediatric care in the primary health care. The system of outpatient monitoring and therapeutic measures in the GP practice. Comprehensive assessment of health and development of children. The main criteria. Distribution of children by health groups. Screening tests. Essential physiological constants.	Quiz Heuristic conversation Testing	3
2	WHO program. The integrated management of childhood diseases (IMChD).	The main core of the IMChD strategy is the integrated management of the most common childhood problems with an emphasis on the main causes of death.	Recitation, Situation-illustration; Situation-abnormalities «Role play» Testing	1
3	Organization of medical and preventive care for newborns.	Comprehensive assessment of health and development of newborns, the main criteria. Risk factors, risk orientation. Differentiated strategies of a follow-up in groups of children at risk. Algorithm of newborns' patronage (inspection, design F112 / y).	Situation-illustration; Situation-abnormalities Design of algorithm of newborns' patronage with the integration of communicatio n skills in the clinical topic Testing	2

4	Neonate health assessment.	Anatomical and physiological features, borderline states, physiological reflexes of newborns, physiological jaundice. Prematurity	«Brain storming» Situation-abnormalities; Discussion of the best decisions and determination of the most correct decision. Testing	1
5	Rational child nutrition in the first year of life.	WHO breastfeeding program. Mode, control and technique of breastfeeding. The timing of the introduction of complementary foods. Hypogalactia: prevention, treatment. Mixed and formula feeding. Adapted milk formulas.	Recitation, Situation-abnormalities Nutrition calculation Training Testing	3
6	Clinical examination of children with background pathologies. Diathesis: Exudative-catarrhal diathesis (ECD), Neuro-arthritic diathesis (NAD), Lymphatic-hypoplastic diathesis (LHD). Atopic diseases	Exudative-catarrhal diathesis, Neuro-arthritic diathesis, Lymphatic-hypoplastic diathesis. Risk groups, clinical examination, prevention, vaccination strategy.	TBL including: modeling; discussion; systemic analysis, formulation and supporting the diagnosis. Power Point Presentation Testing	3

7	Clinical examination of children with background pathologies. Chronic digestive disorders: Hypotrophy, Hypostature, Paratrophy. Obesity and metabolic syndrome in children	Hypotrophy, Hypostature, Paratrophy. Risk groups, clinical examination, prevention, ~~tactics of vaccination.~~	**Case-study** including: brainstorming; modeling; discussion systemic analysis, formulation and supporting the diagnosis Testing	3
8	Clinical examination of children with background pathologies. Rickets.	Diagnostics. Differential diagnosis with rickets-like diseases. Treatment, prevention. ~~Hypervitaminosis D. Risk groups, clinical examination, prevention, vaccination tactics.~~	CBL, Situation-abnormalities Power Point Presentation	3
9	Clinical examination of children with background pathologies. Iron-deficiency anemia.	Management of children with IDA in the primary health care. WHO program for IMChD. Risk factors, causes, clinical and laboratory diagnosis of IDA. Differential diagnosis with other deficiency anemias. Clinical examination, treatment, prevention.	Interpretation of a clinical blood test with missed elements Power Point Presentation	3
10	Specific prevention of infectious diseases in children	Active immunization, indications and contraindications for prophylactic vaccinations. National vaccination calendar of Kazakhstan. The organization of the vaccination office. Vaccine reactions, complications. Differentiated strategies of immunization of children at risk.	Situation-illustration; «Round table» problem solving and exercises in independent thinking; Situation-abnormalities. Testing	3

11	The outpatient management of children with respiratory disorders	Maintaining children with broncho-obstructive syndrome, bronchitis, pneumonia. The introduction of the program of IMChD for the management of patients with ARVI, bronchitis, pneumonia.Management patients with asthma	Heuristic conversation; Situation-abnormalities; X-ray image analysis. Testing	3
12	Functional disorders of gastrointestinal tract in children.	~~Features of intestinal microbiota formation in children.~~ Functional dyspepsia in children. Rome Criteria IV Prevention. Clinical and laboratory diagnostics. Treatment, clinical examination, prevention.	Case-study including: brainstorming ; modeling; discussion; systemic analysis. Testing	3
13	Urinary tract infections (cystitis, pyelonephritis, ~~glomerulonephritis~~).	Clinical and laboratory diagnostics, treatment, prevention, clinical examination.	Recitation, Individual-collective method; Situation-abnormalities. Testing	3
~~14~~	~~Congenital and acquired heart valvular diseases in children.~~	~~Differential diagnosis. Dispensary observation. Principles of treatment.~~	~~Heuristic conversation; Situation-deflection; Power Point Presentation Testing~~	~~3~~
	Total			**37**
		Surgical disorders in the GP practice		

1	Principles of diagnosis and management of outpatients with the most common surgical diseases	Organization of work in the surgical and dressing room in the primary health care facilities. Principles of outpatient diagnosis and management of patients with the most common surgical diseases. The concept of "minor surgery", GP strategy. Panaritium, ingrown nail, lipoma, circulatory disorders in the lower extremities, hemorrhoids, anal fissure.	Interactive	3
2	~~Tactics of management the patients with wounds and wound infections on an outpatient basis.~~	~~The significance of the presence of somatic background diseases in patients with wounds, their effect on the healing of the wound suture. Features of wounds treatment in patients with diabetes mellitus, arterial hypertension, systemic diseases. The need for the correction of diseases of general therapeutic profile. Indications for surgeon consultation and hospitalization in a surgical hospital.~~	~~Interactive~~	~~3~~
3	Early diagnosis of precancerous and cancerous diseases in the GP practice.	Characteristics of precancerous and cancerous skin diseases: morbidity and mortality, localization, age, epidemiology. Etiological factors. Premalignant skin diseases: primary and secondary. ~~Clinic, diagnosis and treatment of skin cancer. General characteristics of melanoma, localization, predisposing factors, pretumor states.~~ Clinical diagnosis and treatment principles of melanoma. Cancer of the lower lip, general characteristics, etiological factors, precancerous diseases. Clinical forms. Diagnostics. Principles of treatment and prognosis.	Interactive	3

4	~~Rehabilitation of surgical patients in the postoperative period on an outpatient basis. Prevention of postoperative sequela.~~	~~Rehabilitation of surgical patients in the postoperative period on an outpatient basis. Prevention of postoperative sequela. Examination of temporary and permanent disability of surgical patients.~~	~~Interactive~~	~~2~~
	Total			**11**
		Obstetrics and gynecology in the GP practice		
1	Outpatient management of pregnant women	Algorithm for the diagnosis of pregnancy in an outpatient environment. Identifying risk groups. Diagnosis of early gestosis and hypertensive states in pregnant women. GP doctor's strategy in gestosis. The threat of pregnancy termination. Bleeding in pregnancy. Indications for hospitalization of pregnant women.	CBL	3
2	Outpatient management of the postnatal period	The condition of the mammary glands and uterine involution in puerperas. Postpartum inflammatory diseases. Prevention of mastitis and bleeding in the postnatal period.	CBL	3
3	Inflammatory diseases of the female genitals in the GP practice.	Principles of the rational diagnosis of inflammatory diseases of the female genitals. Minimum screening for the laboratory diagnosis. The treatment in the primary health care. Preventive monitoring. ~~Approximate terms of temporary disability. Features of inflammatory diseases of the genital sphere in childhood and adolescence.~~	CBL	3
4	Menstrual disorders at different ages. GP strategy.	Menstrual disorders at different ages. Perimenopause and menopause. Climacteric disorders.	CBL	2
	Total			**11**
	TOTAL			**105 h**

Subject content of students' self-study under a teacher's supervision

Form №3

№	Topic	Objectives	Type of activities	Hours
		Mental diseases in the GP practice		
1	Clinical protocol for the diagnosis and treatment of patients with coronary artery disease. Stable exertional angina.	~~Definition, clinical classification,~~ indications for emergency and planned hospital admission. The main outpatient diagnostic examinations. Rules for recording and interpretation of ECG (a practical skill). The aim of treatment. Non-drug and drug therapy in the outpatient environment. Emergency assistance in the primary health care.	Interactive	3
2	Clinical protocol for the diagnosis and treatment of patients with arterial hypertension.	~~Definition, clinical classification,~~ Stratification of total cardiovascular risk by category. Risk factors. The list of main and additional diagnostic measures. Rules of blood pressure measurement in the office (practical skill)~~. Diagnostic criteria for diagnosis. Differential diagnosis.~~ Aim and strategy of the treatment. Drug therapy. Writing up prescriptions according to Guaranteed Volume of Medical Care (practical skill). Patient care training.	Interactive	3
3	Clinical protocol for the diagnosis and treatment of patients with Ventricular and supraventricular arrhythmias and the prevention of sudden cardiac death.	~~Diagnosis and treatment of patients with ventricular and supraventricular arrhythmias on an outpatient basis. Consultation with specialized doctors.~~ The algorithm of action in the case of emergency conditions. Monitoring of the patient status. Indications for hospitalization.	Interactive	3

4	Clinical protocol for the diagnosis and treatment of patients with congestive heart failure (CHF).	~~Definition, NYHA Classification, diagnostic criteria according to European guidelines.~~ Laboratory markers of CHF. Instrumental research methods. Aim and strategy of treatment.	Discussion	3
5	Clinical protocol for the diagnosis and treatment of adult patients with pneumonia	Rational antibacterial therapy of pneumonia according to the protocol.	Interactive	3
6	Clinical protocol for the diagnosis and treatment of patients with Acute bronchitis and Chronic obstructive pulmonary disease.	~~Work in a functional office.~~ X-ray. ECG. Spirography. Peakflow measurement. Working in the GP office. Writing a report on the work in the GP's office.	Interactive	3
7	Mastering practical skills in the clinical training center.	~~Auscultation of the lungs and heart~~ Recording and interpretation of ECG (norm and myocardial infarct) Recording of broncho-obstructive syndrome (nebulizer) Measuring blood sugar, cholesterol and triglycerides.	Standardized patient or work with mannequins	3
8	Clinical protocol for the diagnosis and treatment of patients with chronic kidney disease	Clinical classification of CKD, diagnosis and treatment in the outpatient environment, indications for hemodialysis and kidney transplantation	Interactive	3
9	Clinical protocol for the diagnosis and treatment of patients with GERD	Clinical classification of GERD, diagnostic criteria, treatment goals, indications for consultation with specialized doctors and hospitalization	Interactive	3
10	Clinical protocol for the diagnosis and treatment of patients with gastric and duodenal ulcers	Clinical classification, diagnostic criteria, indications for eradication of H.pylori. Treatment plan according to the Maastricht-4 protocol	Interactive	3

11	Clinical protocol for the diagnosis and treatment of patients with Chronic cholecystitis and chronic pancreatitis	Clinical classification, diagnostic criteria, Differential diagnosis, indications for hospitalization, goals and treatment plan.	Discussion	3
12	Clinical protocol for the diagnosis and treatment of patients with cirrhosis	Diagnostic criteria for cirrhosis, clinical classification by Child-Turcotte-Pugh, differential diagnosis, treatment in polyclinic conditions, indications for hospitalization	Interactive	3
13	Clinical protocol for the diagnosis and treatment of patients with iron deficiency anemia	The etiopathogenesis of IDA, clinical classification, diagnostic criteria, laboratory methods of diagnosis, indications for consultation of specialized doctors and hospitalization. Principles of treatment. Prescription of drugs from the list of Guaranteed Volume of Medical Care (iron preparations)	Interactive	3
14	~~Clinical protocol for the diagnosis and treatment of patients after heart surgery (stage III)~~	~~Principles of rehabilitation of patients after heart surgery (CABG, stenting, replacement of the valves of the medulla) in ambulatory settings, contraindications, therapeutic exercises, medical correction~~	~~Discussion~~	~~3~~
15	Clinical protocol for the diagnosis and treatment of patients with Rheumatoid arthritis and Osteoarthrosis	Diagnostic algorithm of RA and osteoarthritis, DAS-28 scale, clinical signs, additional diagnostic methods, goals and treatment plan, writing up prescriptions from the list of the Guaranteed Volume of Medical Care drugs (prednisone, metotrex, metipred)	Interactive	3
16	Clinical protocol for the diagnosis and treatment of patients with type 2 Diabetes	Diagnostic algorithm for type 2 diabetes, screening, differential diagnosis, principles of outpatient care, monitoring, patient care training, motivational interviews, lifestyle changes, medication, writing up prescriptions from the list of Guaranteed Volume of Medical Care (insulins, hypoglycemic drugs)	Interactive	3

17	Clinical protocol for the diagnosis and treatment of adult patients with Hypothyroidism and thyrotoxicosis	~~Etiopathogenesis, clinical classification,~~ diagnostic criteria, laboratory diagnostic methods, indications for specialist consultation and for hospitalization	Interactive	3
18	Clinical protocol for the diagnosis and treatment of patients with obesity	~~Etiopathogenesis of IDA, clinical classification, diagnostic criteria, laboratory methods of diagnosis,~~ indications for consultation of specialists, ways to correct the metabolism (drug and non-drug). Motivating interview.	Discussion	3
	Total			60 h
		Children's diseases in the GP practice		
1	~~Principles of clinical examination of healthy children. Assessment of the children level of health.~~	~~Clinical examination of children, age features. Directory materials of RK. Comprehensive assessment of children health and development. The main health criteria. Determining the level of children's health, practical skills.~~	~~Training Situation - judgement~~	~~3~~
2	WHO program. Integrated management of childhood diseases (IMCD)	The WHO program. Integrated Management of Childhood diseases (IMCD), the most common problems of childhood: ARI, AEI.	Situation illustration; Situation-abnormalities. Testing	4
3	~~Organization of medical and preventive care for newborns.~~	~~Newborns. Health criteria, factors and risk orientation. Algorithm for recording the patronage of newborns (inspection, execution of F112 / y).~~ ~~medical records to register all the pathologe of child healthe and laboratory assesment~~	~~Situation - deflection; Situation illustration; Discussion of the best solutions and determination of the most relevant solution. Testing~~	~~4~~

4	Neonate health assessment.	Health assessment of newborns. Physiological jaundice. ~~Prematurity, principles of observation, recovery.~~	Power Point Presentation Application of the newborn's observation according to F 112/y	4
5	Rational child nutrition during the first year of life.	WHO breastfeeding program. Mode, control and technique of breastfeeding. The basic principles of feeding. Indications for mixed and formula feeding. Adapted milk formulas. Control feeding.	Situation-deflection; Nutrition calculation Training Power Point Presentation Testing	3
6	Clinical examination of children with background pathology. Diathesis: Exudative-catarrhal diathesis (ECD), Neuro-arthritic diathesis (NAD), Lymphatic-hypoplastic diathesis (LHD).	Diathesis: Exudative-catarrhal diathesis, Neuro-arthritic diathesis, Lymphatic-hypoplastic diathesis flow features. Risk groups, clinical examination principles, prevention, vaccination strategy. ????	Modeling; Systemic analysis; formulation and supporting the diagnosis. Power Point Presentation Testing	3
7	Clinical examination of children with background pathology. Chronic digestive disorders: Hypotrophy, Hypostatura, Paratrophy.	Chronic digestive disorders: Hypotrophy, Hypostatura, Parathrophy, degrees of dystrophy. Risk groups, clinical examination, predparation treatment periods, prevention, ~~vaccination tactics.~~	**Case-study** Systemic analysis, formulation and supporting the diagnosis Testing	3

8	Clinical examination of children with background pathology. Rickets.	Rickets. ~~Diagnostics. Differential diagnosis with rickets-like diseases. Treatment, prevention. Hypervitaminosis D. Risk groups, clinical examination, prevention.~~	Situation-deflection Power Point Presentation	3
9	Clinical examination of children with background pathology. Iron-deficiency anemia.	Iron-deficiency anemia. Management of children with IDA at the level of primary health care. The WHO program is IMCD. ~~Risk factors, causes, clinical and laboratory diagnosis of IDA.~~ Clinical examination, treatment, prevention.	Situation illustration; Situation-deflection Power Point Presentation	3
10	Specific prevention of infectious diseases in children	Specific prevention of infectious diseases in children. National Vaccination Calendar. Existing Policy Materials of the Republic of Kazakhstan (Recommendations, Ordinances) on vaccination.	Situation illustration; Situation-deflection Drawing up an individual vaccination calendar Testing	3
11	The outpatient management of children with respiratory pathology	Pathologies of the respiratory system in children. The introduction of the IMCD program for the management of ill children with ARVI, bronchitis, pneumonia. The treatment of bronchial asthma in children. Algorithm for the treatment management of children with community-acquired pneumonia (Guidelines for the treatment of community-acquired pneumonia in children).	Discussion of the best solutions and determination of the most relevant solution based on X-ray analysis. Testing	3
12	Functional disorders of children gastrointestinal tract.	Functional disorders of children gastrointestinal tract. Treatment, clinical examination, prevention. Practical skills	**Case-study** including: systemic analysis. Testing	3

13	Urinary tract infections	Clinical and laboratory diagnostics, treatment, prevention, clinical examination. (cystitis, pyelonephritis, ~~glomerulonephritis~~).	Individual-collective method; Situation-deflection Testing	3
14	~~Congenital and acquired heart valvular diseases in children.~~	~~Congenital and acquired heart valvular diseases in children. Differential diagnosis. Dispensary observation. Principles of treatment.~~	~~Situation-deflection; Power Point Presentation Testing~~	~~3~~
	Total			45
		Surgical diseases in the GP practice		
1	Principles of the outpatient diagnosis and management of patients with inflammatory diseases of the mammary glands.	Review the clinical protocols for the outpatient management of patients with inflammatory diseases of the mammary glands. ~~The list of basic and additional diagnostic measures for patients with inflammatory diseases of the mammary glands on an outpatient basis. To diagnose and treat diseases of inflammatory diseases of the mammary glands according to the clinical protocol. Indicators of the effectiveness of treatment of patients with inflammatory diseases of the mammary glands in an outpatient setting.~~	Interactive	3
2	Principles of the outpatient diagnosis and management of patients with diseases of the rectum.	Review the clinical protocols. ~~Hemorrhoid classification according to A.N. Ryzhih, 1956. The list of main and additional diagnostic measures.~~ Differential diagnosis of pain in the anus and perianal region. Aim and treatment of outpatients with rectal diseases.	Interactive	3

3	Principles of the outpatient diagnosis and management of patients with varicose veins of the lower extremities.	Review the clinical protocols. To diagnose and treat varicose veins of the lower extremities according to the clinical protocol. ~~Clinical classification by CEAP. The correlation between the classification by CEAP and ICD10.~~ Surgical outpatient interventions performed in patients with varicose veins of the lower limbs.	Interactive	3
4	Principles of the outpatient diagnosis and management of patients with purulent inflammatory diseases of the hand.	Review of the outpatient clinical protocols of patients with purulent inflammatory diseases of the hand. To carry out diagnostics and treatment of purulent inflammatory diseases of the hand according to the clinical protocol. Indications for surgery of outpatients with purulent inflammatory diseases of the hand. Treatment objectives and strategies in outpatients with purulent inflammatory diseases of the hand.	Interactive	3
	Total			15
		Obstetrics and gynecology in the GP practice		
1	Managing normal pregnancy in the GP practice	Review of the clinical protocol of the management of a physiological pregnancy.	Interactive	3
2	Managing a puerperal patient in the GP practice	Review of the clinical protocol of management of the puerperal patient in the outpatient environment.	Interactive	3

3	Inflammatory diseases of female genitals in the work of GP	Clinical protocol Inflammatory organs of the lesser pelvis (salpingitis, oophoritis, salpingo-oophoritis) November 20, 2015 Protocol No. 16, Inflammatory diseases of the perineum, vulva and vagina (Bartholinitis, vulvitis vaginitis) of June 9, 2016. Protocol number 4, to acquire and implement the knowledge and skills for the diagnosis and treatment of inflammatory diseases of the female genitals in the work of the GP	Interactive	3
4	Disorders of the menstrual cycle at different ages. GP strategy.	Clinical protocol of Menstrual irregularity dated July 4, 2014, protocol No. 10, to acquire and implement knowledge and skills in the diagnosis and treatment of menstrual dysfunctions in various ages and GP strategy	Interactive	3
	Total			15

Plan for the organization of students' self-study Form №5

№	Topic	Hours	Type of activities	Deadline
	Mental diseases in the GP practice			
1	Treatment of the patient with the application of the outpatient training chart with disability examination.	15	Application of the outpatient training chart	12th class
2	Anamnesis collection from patients, writing an essay	6	~~Write an essay~~ Oral presentation of a case report	3rd class
3	Drafting a chronic patient follow-up observation scheme	6	Drafting a follow-up observation scheme	4th class
4	Principles of organization of schools for the management of	6	~~Presentation~~	5th class

	patients with socially significant diseases (IHD, arterial hypertension, diabetes mellitus, bronchial asthma, COPD, chronic heart failure)			
5	Working in functional diagnostics offices in the primary health care, writing a report.	12	~~Writing the report.~~	6th class
6	A search for reliable information on topical disorders in the management of outpatients (based on the principles of evidence-based medicine).	15	~~Presentation~~	10th class
	Total	60 h		
	Children's diseases in the GP practice			
1	Care and medical examination of newborns and mothers following a discharge from the maternity hospital	5	~~Presentation~~	4th class
2	Patronage of the newborn with the application of the algorithmic inspection chart according to F 112 / y.	10	Application of the training chart	6th class
3	A "Healthy child" office practice	5	Report	8th class
4	Individual calendar of vaccinations of children with background diseases.	5	Vaccination schedule	10th class
5	Clinical examination of children with long-term and chronic diseases based on the principles of evidence-based medicine, according to the existing Clinical Protocols of the Ministry of Health of the Republic of Kazakhstan	10	Drafting the scheme of the follow-up observation - Report	12th class
6	A search for reliable information on topical disorders in the	10	~~Presentation, report~~	13th class

	management of outpatient children based on the principles of evidence-based medicine.			
7	WHO growth charts		~~Report~~	
	Total	45h		
	Surgical diseases in the GP practice			
1	Participation in the work of the surgical and / or dressing room, writing a report.	3	Application of the training chart	2nd class
2	Description of the local status of the surgical patient	6	Application of the outpatient medical training chart	2nd class
3	Prevention and early diagnosis of circulatory disorders in the extremities, a preparation of presentations.	3	~~Presentation~~	4th class
4	Diseases of the rectum and anus. GP strategy. Practicing skills in the Practical Skills Center.	3	Practice the skills in the Practical Skills Center	3rd class
	Total	15 h		
	Obstetrics and gynecology in the GP practice			
1	Participation in birthing schools, women's counseling centers and family planning centers, writing a report.	3	~~writing a report~~	3rd class
2	Patronage of the pregnant and / or puerperal at home with the application of the chart.	6	Application of the chart	2nd class
3	Prevention and early diagnosis of fetal congenital abnormalities, a preparation of a presentation or the analysis of the pregnant patient's individual chart.	3	~~presentations or~~ analysis	4th class

4	Participation in the counseling for adolescents and women in the postmenopausal period, writing an essay.	3	~~writing an essay~~	4th class
	Total	15		

Anamnesis collection from patients, writing an essay	6	Write an essay

Participation in the counseling for adolescents and women in the postmenopausal period, writing an essay.	3	Writing an essay

Principles of organization of schools for the management of patients with socially significant diseases (IHD, arterial hypertension, diabetes mellitus, bronchial asthma, COPD, chronic heart failure)	6	Presentation

A search for reliable information on topical disorders in the management of outpatients (based on the principles of evidence-based medicine).	15	Presentation

Care and medical examination of newborns and mothers after discharge from the maternity hospital	5	Presentation
Working in the functional diagnostics offices in the primary health care, writing the report.	12	Writing a report.

A "Healthy child" office practice	5	Report

A search for reliable information on topical disorders in the management of the	10	Presentation, report

outpatient children (based on the principles of evidence-based medicine).		
WHO growth charts		Report

Prevention and early diagnosis of circulatory disorders in the extremities, a preparation of a presentation.	3	Presentation

Prevention and early diagnosis of fetal congenital abnormalities, a preparation of a presentation or the analysis of the pregnant patient's individual chart.	3	presentation or analysis

Attachment 1B.1

Development of a competencies model for WKMOMU teachers including criteria for the teacher selection, recruitment, training and evaluation system

On the basis of the documents received from WKMOMU, as well as the results of the meetings with both WKMOMU and PUMS experts, document analysis, as well as the recognition of the specificity of teachers' employment, and the evaluation system at the WKMOMU was performed. The emerging problems were discussed comprehensively, and the unclear issues were clarified in order to avoid misunderstandings and familiarize with solutions.

The analysis of the data from WKMOMU was compared with the PUMS model, and the proposal for building the competencies of the WKMOMU academic staff, including the criteria of teacher selection, recruitment, training and evaluation was developed.

Conclusions:

- the procedures of teacher selection, recruitment, and training should be:
  - reconsidered and simplified,
  - adapted and related to the teacher/employee position at the WKMOMU,
  - unified for each group of teachers,
- the evaluation of teachers:
  - "a professional development plan" should be replaced by "a professional development report" presented by a teacher after a predetermined period of time, and related to the teaching position (teaching, research),
  - should be performed clearly, according to the specified and unified criteria for each employment position, and they should fully respect the evaluation criteria,
  - has to be obligatory for an individual teacher,
  - it is recommended to establish a link between income/bonuses/extra salary with individual achievements of a teacher, as a motivation for research activity, and a stimulus for a further academic career,
  - a corporate assessment model with appropriate criteria is necessary for the evaluation of a department or a faculty.

The proposal of the competencies development of WKMOMU teachers including the criteria for the system of teacher selection, recruitment, training and evaluation.

The main goal of the proposed regulations and changes in the selection and recruitment policy is to increase the efficiency of the teaching and research activity.

The competency building model, personal responsibility, and the motivation for a teacher to pursue research activity as well as the evaluation system should include new simplified recommendations, and address:

- the specificity of a medical university,
- clinical activity of teachers/physicians,
- basic and pre-clinical sciences lecturers' workload with a reduced teaching load for young teachers,
- special recruitment criteria as well as a selection and training procedure for young teachers offering them prospects for personal development,
- teacher evaluation based on their individual activity.

I. Recruitment and selection of candidates for teachers

1. The type of vacancy or a new faculty position results from the teaching load of the department, and is strictly related to the teaching needs, courses covered, number of students, and the structure of the department. A candidate is applying for the position according to his/her education profile.
2. Recruitment and selection of highly motivated teacher candidates require regulations for different types of academic positions and should be precisely defined.
3. A competition is obligatory for a full-time position. The rector or the dean of the faculty appoints the competition commission, and its members (maximum 6 persons) are professors/assistant professors representing the relevant discipline. The vice-rector is the head of the commission (it should be in accordance with the transfer of competencies in education and human resources policy and management to the Universities in Kazakhstan in 2018).
4. Recruitment and selection criteria should be published on the University's website.
5. The regulations should define:
   - type of a given position (teaching, research and teaching, research, technical staff - lab technician),

- list of the required documents to apply to the WKMOMU for individual teaching positions (assistant, teacher, professor),
- professional duties and responsibilities for individual position,
- teaching and research activities in the teaching load, taking into account the position of the academic staff, although research staff members, as well as research and teaching staff should be expected to have fewer obligatory hours with students in favor of research activities
- minimal criteria for the specific position - the candidate should be provided the final score, and information regarding his/her strengths and weaknesses,
- development and promotion opportunities related to the education level, position.

6. Documents necessary to apply for:
   - a research or research and teaching position:
     - application form,
     - CV: education level, professional qualifications, diploma (MD, MSc, PhD, other),
     - list of scientific publications (original, review, abstracts, proceedings, IF, other evaluation factors) and teaching achievements (the number of graduates promoted),
     - previous research experience - grants, projects, international academic training,
     - for professor position – a list of MSc and PhD graduates promoted, doctoral students,
     - knowledge of a foreign language (preferably English), soft skills.

   - teaching (lecturer) position:
     - application form,
     - CV: education level, teaching qualifications, diploma (MD, MSc, PhD, other),
     - previous teaching achievements/experience, list of graduates promoted
     - knowledge of a foreign language (preferably English), soft skills.

The recruitment criteria and the selection procedure of young teachers require particular attention, and therefore should include:

- application form and CV with resume regarding the academic position,
- diploma (MD, MSc, others),
- previous teaching/scientific achievements/experience (if available),
- knowledge of a foreign language (preferably English), soft skills.

The teaching and/or research development pathway should be presented to the candidates (within the criteria), and should identify opportunities for training courses in teaching and research methodology, grants, workshops and foreign languages courses for young scientists with financial assistance from the university.

The training and evaluation of teachers

1. The training of teachers should be related and differentiated for the research and research and teaching positions, and based on their individual activity, with regard to their contribution to the teaching and scientific achievements of the department, it should also enable and encourage personal development.
2. The professional training should be related to the position and obligatory for:
   - teachers (lecturer, teaching staff)
   - research staff members (research staff, technical assistants),
   - administrative staff.
3. In the complete competency-building system, compulsory training pathways for teaching positions and teacher salary regulations are essential.
4. The training courses should be organized by respective divisions of the university and planned prior to the new academic year. Course syllabuses and schedules should be published on the website and be at the disposal of the interested university staff members.
5. The final results of the training courses should affect salaries or bonuses of the participants. The staff may be recommended to participate in the courses for professional development and advancement.
6. The improvement in cooperation, by the consultations and frequent exchange of opinions, needs, plans, tasks, information and decisions of the University authorities (rector, deans, heads of units), is recommended between:
   - teaching and research departments,
   - clinical departments involved in the teaching and research activity,
   - administrative departments: Division of the Administrative and Personnel Work, Centre for Continuous Professional Development, Division of Postgraduate Education and International Cooperation, Human Resources Management Department and Department of Scientific and Analytical Work.

7. The staff evaluation model is presented in the Task 1A2 Report mainly (*cited below*), consistent with the Task 1B3 model.

   Periodic evaluation should
   a. *apply to both research and teaching as well as teaching staff members,*
   b. *be available for the evaluated employees and their immediate supervisor,*
   c. *be comprehensive - taking into account the opinion of the immediate supervisor and students, depending on the post held,*
   d. *be precisely defined and contain the minimum expectations for the research and teaching staff members, as well as teaching staff; in the case of the former group, this evaluation should take into account the number and quality of published*

scientific papers, obtained patents and awarded grants, active participation in foreign conferences, as well as properly parameterized expectations with regard to teaching; in the case of teaching staff, the periodic evaluation should solely concern teaching activities; periodic evaluation of the research and teaching, as well as teaching staff members should also include the completion of an English language course, which should not be less than 1 course every two years,

e. *be conducted at least once every 5 years following the expiration of the previous evaluation. A more frequent (once every 3 or 4 years) evaluation of the academic staff and research employees can be established when it is regulated by an internal normative document,*
f. *be performed always immediately before a promotion related to the post held,*
g. *be conducted by an independent commission,*
h. *positive, conditionally positive or negative; in the case of a conditionally positive evaluation, the next periodic evaluation should follow in less than two years; in the case of a negative evaluation, the next evaluation should take place after one year, whereas receiving another negative evaluation should result in the dismissal from the post held.*

8. The criteria of the head of department evaluation should be established by the dean of the faculty, or the rector and connected with:
   - personal achievements – publications, conferences, activity in teaching trainings (essential for the academic career), new soft skills and improvement in foreign language
   - the role as a leader – tasks distribution within the team, supervision and coordination of the teaching process, stimulating young teachers development, promotion of the academic staff (PhD, clinical specialization), applying for awards, grants, and financing staffs participation in scientific conferences.
9. The criteria for the staff members evaluation holding the position of the associate professor and PhD ("candidate of sciences") should be established in order to stimulate their activity in achieving a higher position (PhD – associate professor – full professor) in a specified period of time (4-6 years).
10. Evaluation criteria for all positions should be reassessed progressively and upgraded every 3-4 years.
11. The list of documents for evaluation of teachers should comprise:
    - a questionnaire:
      - education (diploma, postgraduate education),
      - position at the University, or at the current workplace,
      - during the evaluated period:

        - scientific achievements:
            - ✓ publications – list, IF, other impact factors,
            - ✓ grants, patents,
            - ✓ international cooperation – scholarships, grants, exchange visits, workshops or webinars (online activity),
        - teaching activity (courses, e-learning and online classes, promoting BSc +MSc),
    - organizational activity, membership in scientific associations (local and international),
- other relevant documents.

12. The final outcome of the periodic and obligatory evaluation related to the position should be available for the candidate/teacher as well as the head of the department/clinical department/dean.
13. The evaluation has to be mandatory with the personal responsibility on the part of the teacher, researcher/employee, or the head of the department for the fulfillment of the criteria.
14. Correlating income/bonuses/extra salary with individual achievements of a teacher is recommended, as a motivational and stimulating factor for further research activity and academic career (not as an achievement of the entire department team; but rather as one of the most important factors in developing the academic staff).

Attachment 1C1 – I

List and technical descriptions of scientific devices located in reference PUMS laboratories

Microbiology laboratory equipment

Device	Count	Manufacturer	Description
Incubator CLN 53 STD	1	Pol-Eko-Aparatura Sp.J.	Incubator is used to incubate samples for microbiological tests and other tests at elevated temperatures.
Laminar flow hood LN090	1	Nüve	Vertical Laminar Flow Cabinets used to work with non-pathogenic biological samples, cell and tissue cultures or pharmaceuticals.
Centrifuge 5810R	1	Eppendorf	Spins liquid samples at high speed e.g. separates the pellet and the supernatant.
Incubator Hood TH 15	1	Edmund Bühler GmbH	Device for incubation of liquids at elevated temperature e.g. microbiological culture media.
Compact Shaker KS 15	1	Edmund Bühler GmbH	The orbital shaker compatible with Incubator Hood TH 15.
Low Temperature Freezer U725 Innova	1	Eppendorf New Brunswick	This is a freezer for storage and preservation of all types of biological material e.g. cells, serum, tissue.
CO2 Back up Innova	1	Eppendorf	Backup system for keeping the freezer contents at a programmed temperature in the event of a power failure.
GSM recorder LB-524	1	LAB-EL	LB-524 works with the LBX program to control the freezer - creates and presents a measurement database and alerts by sending an SMS if humidity and temperature thresholds are exceeded.
Shaker DUOMAX 1030	1	Heidolph	Universal shaker with oscillatory motion for shaking tubes 1,5-50 ml.
Centrifuge Mini Spin plus®	1	Eppendorf	It can be used to spin 12 samples in Eppendorf tubes of capacity 1,5-2 ml simultaneously
Gas-jet Fireboy	1	Integra	Used for flame sterilization of instruments used in microbiological culture
Vacuum pump Welch-ILMVAC MPC 090 E	1	ILMVAC	The single-stage vacuum pump is used for pumping gases, vacuum filtration, as a source of vacuum in vacuum concentrators
Biochemical pipettes (different kinds): Eppenndorf Reference 2/ Research Plus	2/1	Eppendorf	Laboratory equipment used for handling and measuring liquids

Nucleic Acids laboratory equipment

Device	Count	Manufacturer	Designation
Spectrophotometer DS11	1	DeNovix	Easy-to-use, compact instrument for rapid nucleic acid and protein quantification both in microvolume 1ul and in cuvettes.
Shaker DUOMAX 1030	2	Heidolph	Universal shaker with oscillatory motion for mixing fluids.
Thermo Mixer C	1	Eppendorf	Device for heating, cooling, and mixing in 2ml and 15ml vessels, mixes liquids in a controlled, circular movement.
Light Cycler 96	1	Roche	Device enabling real-time quantitative PCR to be carried out with 5 fluorescent dyes; Simultaneous amplification and detection of up to 96 samples on 96-well plates or strips; reaction volume: 10-100ul.
Centrifuge Mini Spin plus®	1	Eppendorf	Device for spinning 12 samples Eppendorf of a capacity 1,5-2 ml at the same time.
Mini Plate Spinner MPS1000	1	Labnet	Device for short spinning the 96-well plate, before placing in thermal cycler block.
Centrifuge IKA® mini G	1	IKA	Mini-centrifuge fits all applications which do not require high speeds, e.g. cell separation. The mini-centrifuge can be used for both PCR-vessels and PCR-strips.
Thermal Cycler T100	2	BIO-RAD	Device for PCR thermal reaction in tubes.
Droplet Digital PCR QX200 System	1	BIO-RAD	The QX200 Droplet Digital PCR (ddPCR) System provides absolute quantification of target DNA or RNA molecules for EvaGreen or probe-based digital PCR applications.
Laminar cabinet Safe Fast Classic 212	1	Faster	Safe working area, both for researcher and samples to avoid contamination. This device is a vertical laminar flow cabinet meeting Class II Microbiological Safety Cabinets standard - designed and built to performance requirements of the EN-12469:2000 European Standard and NSF/ANSI 49 American Standard, with 70% of the air re-circulated via the main H14 HEPA/ULPA filter according to EN 1822 within the cabinet, whilst the remaining 30% is discharged through an exhaust H14 HEPA/ULPA filter.
Fume hood	1	DCD LAB	Safe working area to limit exposure to hazardous or toxic fumes, vapors or dusts; it is designed to protect personnel against toxic, malodorous gases and dust occurring when working with chemicals.
Centrifuge 5810R	1	Eppendorf	Device for spinning liquid samples at high speed e.g. separating the pellet and the supernatant.
Power Supply PowerPac Basic	2	BIO-RAD	The PowerPac™ Basic power supply is recommended for basic applications such as submerged horizontal and mini vertical gel electrophoresis. Aplications: Nucleic acid gel electrophoresis, Protein gel electrophoresis.
Microwave	1	BOSCH	Device used in laboratory for preparing the agarose gels (warmning buffer with agarose).
Laboratory scale PCB	1	KERN	Device for determination of the weight value of items.
Biochemical pipettes	16	Eppendorf, Brand	Laboratory equipment used for handling and measuring liquids.

Biochemistry laboratory equipment

Device	Count	Manufacturer	Designation
Synergy H1 microplate reader	1	BioTek	Hybrid multi-mode microplate reader for reading absorbance, fluorescence and luminescence, cooperating with the program Gen5.

Guava easyCyte HT	1	Merck	Microcapillary flow cytometry systems to analyzing cells. Common assays include: immunophenotyping, cell signaling, cell health and compound screening.
Centrifuge 5804R	1	Eppendorf	The equipment, which spins liquid samples at high speed e.g. separates the pellet and the supernatant.
Shaker DUOMAX 1030	1	Heidolph	Universal shaker with oscillatory motion for shaking tubes 1,5-50 ml.
Centrifuge IKA® mini G	1	IKA	Mini-centrifuge for 1,5-2 ml tubes. This centrifuge is for all applications which do not require high speeds, e.g. cell separation. The mini-centrifuge can be used for both PCR-vessels and PCR-strips.
Centrifuge Mini Spin plus®	1	Eppendorf	It can be used to spinning 12 samples Eppendorf of a capacity 1,5-2 ml at the same time.
Laboratory scale ABT 100-5M	1	KERN	It is to determination of the weight value of items.
Pump wash	1	Capp	Plate washer with 12-channel and a 16-channel.
Magnetic strirrer	1	Heidolph	Laboratory equipment for non-contact mixing of liquids in laboratory vessels.
pH/Ion meter S220	1	Mettler Toledo	Used to measuring the pH of a solution.
Biochemical pipettes	6	Brand	Laboratory equipment used for handling and measuring liquid.

Histology and Embryology Department equipment

Device	Count	Manufacturer	Description
Western-blot chamber with power supply	1	Bio-Rad	It is designated to perform electrophoresis of DNA, RNA and proteins.
Turbo-blot	1	Bio-Rad	This equipment serves RNA and protein transfer from a gel to a membrane.
Millipore Muse™ Cell Analyzer	1	Millipore	Separates cells. A flow cytometry instrument.
15 and 50 ml incubator	1	IKA	Heats large laboratory test tubes, 15- and 50 ml.
Thermomixer	1	Eppendorf	This device is intended for heating and mixing samples in laboratory test tubes.
Agarose gel documentation system (UV-Doc)	1		This apparatus is used to photograph and document gels containing fragments of DNA or RNA chains. These molecules are contrasted with intercalating compounds such as SYBR green.
Different chambers for DNA/RNA electrophoresis with power supply	2	Bio-Rad	Devices for electrophoresis are used to separate both DNA and RNA chains.
Plate Reader Synergy 2	1	Biotek	The plate reader is designed to read absorbance changes of various reagents. It can be used to quantify total protein. It can also be used to quantify live (viable) / dead cells using a specific reagent kit.
Centrifuge with cooling system and different rotors	1	Eppendorf	Centrifugation with specific temperature requirements.
Table centrifuge	2	Eppendorf	Centrifugation.
Fluorescence Advance Microscope Carl Zeiss	1	Carl Zeiss	Microscopic sample observation and assessment.
Cytospin 4 ThermoScientific	1	ThermoScientific	Cytospin is used to pellet cells cultured in vitro

Electroporator Bioraptor Plus	1	Diagenode	This device is used to degrade nucleic acids using ultrasonic waves.
Membrane and gel aquisition system	1	GE Amersham	This system allow photographing membranes, most often in the Western-blot process.
HL-2000 HybrLinker			The hybridization oven is used to carry out the northern blot nucleic acid hybridization.
Spectrophotometer ND-1000	1	NanoDrop	NanoDrop allows evaluation of the amount of DNA / RNA / protein in cell lysates.
Laboratory scale	1	Sartorius	Precision measurements.
Schuett homogen	1	Schuett company	Tissue homogenizer produces cell lysates from tissues
Electron microscope	1	Joel	Ultrastructural analysis of tissues and cells.
CFX96 Deep Well Real-time System	1	Bio-Rad	For the performance of PCR in real-time.
T100 Thermal Cycler	1	Bio-Rad	For the performance of PCR reaction
Autostainer XL	1	Leica	This device is designed to dewater paraffin sections in a fully automatic process.
Auto cover slip CV5030	1	Leica	System for automatic coverslipping.
3130 Genetic Analyzer	1	Hitachi	The device for automatic DNA sequencing using Sanger method.
7900HT Fast Real-Time PCR System	1	Applied	For the performance of PCR in real-time.
Laser Scanning Confocal Microscope Fluoview FV10i	1	Olympus	Scanning microscope for fluorescence analysis.

Department of Pediatric Gastroenterology and Metabolic Diseases equipment

Device	Count	Manufacturer	Description
Gas Chromatograph with MS Detector	1	Agilent	Gas chromatography with mass spectrum identification (allows for analyzing e.g. long-chain polyunsaturated fatty acids, short-chain fatty acids, and sterols).
High-performance Liquid chromatograph (HPLC)	1	Agilent/Hewlett Packard	High-performance liquid chromatography (allows for analyzing e.g. fat-soluble vitamins).
Atomic Absorption Spectrometer	1	Thermo	Microelements determination. Feasibility depends on sample type and microelement concentration.
Centrifuge with cooling	1	MPW	Serum separation and sample preparation.
ELISA plates reader	1	Bio-Tek	Absorption reader for enzyme-linked immunosorbent assay (ELISA) tests.
ELISA plates washer	1	Dia Sorin	Plates washing during ELISA test performance.
Microwave digestion system	1	Milestone	Sample preparation for atomic absorption spectrometry analysis. High pressure and high temperature digestion in PTFE tubes.
Solid Phase Extraction Set (SPE)	1	Macherey – Nagel	Sample preparation / cleaning for further analysis.

Thermostat Cabinet	1	POL-EKO	Sample and reagent storage or incubation.
Thermo shaker	1	Biosan	ELISA plates incubation with rotary shaking.
Ultrasonic bath	1	Polsonic	Sample dissolution.
Heating block	1	Labnet	Sample heating.
Mini centrifuge	1	Biosan	Centrifugation, for Eppendorf tubes only.
Vortex – type shakers	5	Biosan, Neolab	Oscillatory motion shaker.
Horizontal shaker	1	SunLab	Gentle horizontal shaking device.
Heating block with nitrogen evaporator	1	VLM	Sample heating and concentration under nitrogen stream.
Freezer	1	Gorenje	Short-term sample storage.
Refrigerator	4	Bosch	Reagent storage, mainly ELISA tests.
Water deionization system	1	Hydrolab	Production of ultra clean water for AAS, HPLC and other laboratory purposes.
Electrophoresis set	1	Bio-Rad	Two chambers enable electrophoresis on agarose gel and polyacrylamide gel.
Nanodrop spectrometer	1	Thermo	Determination of DNA, RNA and proteins concentration in small sample volume.
Centrifuge	1	MPW	Small centrifuge without cooling.
Heating block	1	Biosan	Small heating device for Eppendorf tubes only.
Thermal Cycler	1	Bio-Rad	For PCR reaction performance in genetic research.
Real Time PCR CFX96	1	Bio-Rad	For PCR reaction performance in genetic research. Enables real time observation of the PCR reaction.
Laminar flow hood NU 126-300E	1	Nuaire	Sample preparation for genetic research.
IRIS-13C (stable isotope breath test)	1	Wagner	Detector of non-radioactive stable isotope 13C. With the use of labelled substrates allows non-invasive assessment of Helicobacter pylori infection, fat and carbohydrate digestion and absorption, gastric motility, microsomal liver function, and other.
BreathTracker SC (hydrogen-methane breath test)	1	Quintron	Trace-gas concentration analyzer measuring hydrogen and methane with correction for carbon dioxide. Allows, among the others, investigation of lactose intolerance and small intestinal bacterial overgrowth.
Microlyzer (hydrogen-methane breath test)	1	Quintron	Trace-gas concentration analyzer measuring hydrogen and methane. Allows, among the others, investigation of lactose intolerance and small intestinal bacterial overgrowth.
Discovery DXA (Dual energy X-ray absorptiometry	1	Hologic	Bone densitometer using dual-energy X-ray absorptiometry. Allows for bone mineral content and body composition assessment.
Solar GI (High resolution manometer)	1	MMS	Integrated gastrointestinal motility unit allowing: 3D high-resolution anorectal manometry (solid-state), high-resolution impedance manometry of the esophagus (water-perfused), electrogastrography; equipped with a set of 6 manometric probes, including high-resolution impedance catheters, and a custom-built pediatric anorectal probe (Unisensor).

Ohmega	1	MMS	24-hour esophageal pH-impedance for the diagnostics of gastroesophageal reflux disease.
ZepHr	1	Sandhill	24-hour esophageal pH-impedance for the diagnostics of gastroesophageal reflux disease.
Digitrapper MK3	1	Medtronic	24-hour esophageal pH-metry for the diagnosis of gastroesophageal reflux disease.
BodPod	1	Cosmed	Air displacement pletysmograph for the investigation of body composition and thoracic gas volume via whole body densitometry.
Quark RMR	1	Cosmed	Indirect calorimeter – assessment of resting energy expenditure.
Nanoduct	1	Wescor	Neonatal sweat analysis system utilized to diagnose cystic fibrosis.
U570 freezer	1	New Brunswick	-80 degr. C frezer
Polar 180 H	1	Angelantoni	-80 degr. C frezer
MinION	1	Nanopore	A third-generation sequencing device.
Bionformatic workstation	1	Nvidia, AMD	Workstation for bioinformatic data analyses and machine learning.
Sound recorders	10	Tascam, Olympus	Professional recording systems used in bowel sound research; work with custom-built microphones developed at the university in cooperation with an industrial partner

Attachment 2A1 – I

The review and the proposal of the modernized program in clinical pharmacology for undergraduate students

I. INTRODUCTION AND PREPARATORY STEPS

I.1.Arguments for the development and insertion of a modern programme on clinical pharmacology into the curriculum for undergraduate medical students

The significance of a clinical pharmacology programme within last decades and even currently is not realized by students and, moreover, by academic teachers. It results in many disadvantages and pitfalls in therapeutic activity of physicians, especially graduates, who do not have their own professional experience. Many studies have shown that medical students do not acquire necessary competencies in clinical pharmacology by the time they graduate and for this reason they are not ready to provide their patients with valuable prescribing. In some western European countries, recent graduates were found to be responsible for a large number of prescribing errors and reported having little confidence in their prescribing skills [1,2,3]. The problem of rational prescribing does not seem to be sufficiently known not only in Europe. A cross-section study performed in India showed that 56% of physicians were aware of the term 'rational drug use' but only 1/3 of them were aware of adverse effects and drug interactions of the drugs they prescribed. Majority of physicians (85%) used standard textbooks as the source of drug information [4]. A recent multicentre study showed a deep deficiency of essential prescribing competencies among 895 graduating medical students from 17 European medical schools [5].

For most of physicians, drug therapy is the main tool of their therapeutic activity and could be the only reason for their better preparation for the rational prescribing of drugs during the undergraduate clinical pharmacology course. Moreover, it should be also taken into consideration that there are several global trends which make rational drug use more complex and difficult: a steady increase in the number of drugs, an increased number of drugs used by an individual patient (polypharmacy), which increases the risk of drug-to-drug interactions, patients who receive drugs are older and suffer from more diseases (polymorbidity) are especially vulnerable to adverse reactions. All of these conditions increase a physician's workload, lead to medical errors and create a risk of avoidable adverse drug reactions. The work overload related to drugs

prescription and rational drugs use is also precipitated by the necessity to consider all data from a continuously growing sources such as evidence-based medicine and new and frequently modernized recommendations for pharmacotherapy of various diseases. An additional problem, not very easily solved, which is now a challenge for all of physicians, is the provision of proper and clear data about drugs prescribed to patients who have access to more sources of opinions and "disinformation", particularly on the Internet. Another factor which affects good prescribing and indicates absolute necessity for a good clinical pharmacology base for each physician are the marketing activities of pharmaceutical companies. Graduating students have to be educated on how to use information and possibilities offered by pharmaceutical companies without influencing effective prescribing decisions [6].

I.2. REVIEW OF PHARMACOLOGY (BASIC PHARMACOLOGY) PROGRAMME AS THE NECESSARY BASE FOR SUCCESSFUL TRAINING IN CLINICAL PHARMACOLOGY

The text in italic originates from the clinical pharmacology programme at WKMOMU .

Effective teaching on general pharmacology constitutes an inalienable base for effective teaching on clinical pharmacology. The teaching on general pharmacology should cover basic knowledge about drugs and basic knowledge about prescribing.

The syllabus for the Pharmacology programme at WKMOMU for undergraduate students indicates the aim of the study as *"To teach the methodology of choosing the most effective and safe drugs or their combinations, taking into account the knowledge of pharmacodynamics and pharmacokinetics, pharmacogenetics, drug interactions, adverse drug reactions, the principles of evidence-based discipline"*. It seems to be too much for the basic pharmacology. The aim of its programme should be focused rather on the acquirement of the reliable basic knowledge about drugs mechanisms of action, their pharmacological activity and adverse effects, their contraindication. The basic pharmacology programme should also cover basic pharmacokinetics (LADME), types and differences in drugs formulations, dosage of several drugs, the most suitable for common diseases and especially for emergencies. The list of drugs which are included in the programme should be provided to students before classes.

The current programme of basic pharmacology indicates as learning outcomes, among other things, some issues belonging evidently to the clinical pharmacology course e.g.: *"On a professional level student searches and processing of data on medicinal products, to advise physicians, pharmacists, and the public regarding their application • evaluates the possibility of using drugs for pharmacotherapy;*". In our opinion, providing an advisory service for physicians and other medical professions should belong to a specialist in clinical pharmacology, which means a physician who is a specialist in this discipline (after graduating the clinical pharmacology residency).

The current programme of basic pharmacology for WKMOMU undergraduate students is generally well-constructed to be the base for the studying of clinical pharmacology, however it requires several corrections considering topics and related teaching hours. See the table below.

Table 1. The detail review of the current basic pharmacology programme (curriculum) at WKMOMU

The current basic pharmacology programme content	Suggested possible changes helpful for further teaching in clinical pharmacology
Agents affecting the cholinergic nervous system lectures: 2 hours practical classes + student's own work under teacher's control: 8 hours Agents affecting adrenergic nervous system lectures: 2 hours practical classes + student's own work under teacher's control: 8 hours	Too many teaching hours, especially for agents affecting the cholinergic nervous system. The significance of these agents for the current practice is really limited. Adrenergic receptor stimulators and inhibitors should be discussed in detail again during classes concerning drugs affecting the cardiovascular system, respiratory system, and other, therefore 10 hours for their review is evidently too long. Our suggestion: 1 hour for agents affecting the cholinergic system (lecture) + 2 hours as practical classes; 2 hours for agents affecting the adrenergic system (lecture) + 4 hours as practical classes. WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.
Drug formulations practical classes + student's own work under teacher's control: 8 hours	Evidently too much time allocated for discussing a very important but not very complex issue. The modern pharmacotherapy very rare require use of medicines prescribed on compounded prescriptions (extratemporaneous) and most of drugs, if necessary, are prescribed using the usual standard prescriptions Our suggestion: drug formulations practical classes + student's own work under teacher's control: 3 hours WKMOMU specialists feedback: they do not accept our suggestion.
Agents used for general anaesthesia lectures: 1 hour	It is a specific class of agents which only a few graduates will use in practice. Therefore, we suggest that an undergraduate student should be familiar with all subclasses and examples but with without details.

practical classes + student's own work under teacher's control: 4 hours	Our suggestion: general anaesthetics lectures: 1 hour practical classes + student's own work under teacher's control: 2 hours WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.
Antiprotozoal and antihelmintic agents practical classes + student's own work under teacher's control: 4 hours	There are only a few classes significant for practice, therefore the time allocated for their studying is too long. Our suggestion: Antiprotozoal and antihelmintic agents practical classes + student's own work under teacher's control: 2 hours WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.
Antiviral agents – absent from the programme	There are many important classes of antiviral drugs such as anti-HIV, anti-influenza, anti-hepatitis, anti-herpes agents. Many of them are encountered by each physician in their ambulatory practice. Our suggestion: Antiviral agents practical classes + student's own work under teacher's control: 4 hours WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.
Anti-malarial agents– absent from the programme	Our suggestion: Anti-malarial agents practical classes + student's own work under teacher's control: 2 hours WKMOMU specialists feedback: they accept our suggestion and intend to introduce into the upcoming academic year.
Analgesics practical classes: 3 hours	It is absolutely too little for analgesics considered as: opioids, non-opioid analgesics and drugs dedicated for neuropathic pain and for colic pain. Our suggestion: Analgesics

	lecture: 1 hour practical classes + student's own work under teacher's control: 6 hours WKMOMU specialists feedback: they accept our suggestion and intend to introduce into the upcoming academic year.
Anticancer agents practical classes + student's own work under teacher's control: 4 hours	Anticancer agents are a group with new properties and mechanisms covered in many classes. Graduating student must know about their mechanisms and side effects. Our suggestion: Anticancer agents practical classes + student's own work under teacher's control: 6 hours WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.
General principles of treatment of acute drug poisoning lecture: 1hour student's individual work:15 hours	Drug poisoning is an essential part of pharmacology. Our suggestion: Drug poisoning lecture: 1hour practical classes + student's own work under teacher's control: 3 hours WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.
Antiarrhythmic agents student's individual work:15 hours	It is a class of agents that is very important in emergencies. Our suggestion: Antiarrhythmic agents practical classes + student's own work under teacher's control: 2 hours WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.
Antihyperlipidemic agents and anti-gout agents student's individual work: 30 hours	Classes of agents (antihyperlipidemic) very commonly used by patients because of growing incidence of metabolic diseases. Extremely important for cardiovascular prophylaxis. Anti-gout drugs should be discussed together with agents used in the therapy of RA Our suggestion:

	practical classes + student's own work under teacher's control: 4 hours for each topic WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.
	There are no classes discussing some essential issues of toxicology. Our suggestion for completion: General toxicology – toxic substances (excluding drugs), mechanism of toxic effects, symptoms, toxidromes, laboratory tests, first aid. Drug-induced poisoning - mechanism of toxic effects, symptoms, laboratory tests, first aid. Our suggestion: practical classes + student's own work under teacher's control: 4 hours WKMOMU specialists feedback: they accept our suggestion in a significant part and intend to introduce into the upcoming academic year.

Types of classes at WKMOMU: lectures; practical classes; student's own work under teacher's control; student's individual work (student's self-education)

The current programme on pharmacology (basic) at WKMOMU covers in total 300 hours including:

lectures: 30 hours

practical classes: 75 hours

student's own work under teacher's control: 45 hours

student's individual work: 150 hours

ECTS - 10

There are three significant errors in the calculation and distribution of teaching hours:

1) student's individual work (student's self-education) is time mostly spend by a student on their own preparation for classes;

Comment: The detail description of the problem is placed with clinical pharmacology programme (curriculum) review.

2) the basic course in pharmacology, as a basic professional course for the medical students, cannot be based on ½ of the total number of hours completed as student's individual work as it is understood at WKMOMU; the character of the course requires a significantly higher number of contact hours;

3) important topics (see the table above) are but shouldn't be completed through student self-education with no teacher help and contribution.

I.3.REWIEV OF CLINICAL PHARMACOLOGY PROGRAMME FOR INTERNSHIP IN INTERNAL MEDICINE

T*he text in italic originates from the clinical pharmacology programme at WKMOMU*.

The aim of the current clinical pharmacology programme for internships on internal medicine at WKMOMU is as follows: *"Preparation of a doctor who is able to provide qualified medicinal care to a patient with common therapeutic diseases in accordance with the principles of evidence-based medicine and modern achievements of diagnostic and treatment technologies".* In our opinion, it is quite not clear what is considered as "*qualified medicinal care"* and who "*a patient with common therapeutic diseases"* is. We guess that it is the result of a very common misunderstanding coming from an incorrect translation from Russian to English (the Russian word "терапия" was incorrectly translated as "therapy", whereas it should have been "internal medicine" because "therapy" in English means only "лечение", therefore there not "therapeutic diseases' but simply "internal diseases"). We also wonder what the authors of the WKMOMU programme had in mind when saying "*modern treatment technologies".* What kind of treatment technologies may be the concern of clinical pharmacology?

Learning outcomes indicated by the authors of the WKMOMU programme on clinical pharmacology are not precisely expressed. According to the current programme, a student should list "*the basic principles of rational pharmacotherapy; dosing principles, methods of drug administration, taking into account the pharmacokinetic and pharmacodynamic parameters of the drug, physiological and (or) pathological profile in a particular patient; risk factors and the likelihood of clinical manifestations of unwanted adverse reactions; methods for the correction of complications caused by the use of drugs*". Some really important issues for clinical pharmacology are mentioned there, but all of these should be known and well interpreted by a student, not just simply listed.

As learning outcomes, the authors of the current programme on clinical pharmacology at WKMOMU mentioned also: "*student should conduct collection of clinical and pharmacological history"* .

We guess that the authors had in mind that a student should be able to take medical history, and we agree of course that a student has to be able to do it but it is not the learning outcome for clinical pharmacology. It is the learning outcome for internal medicine, a course the completion

of which is a prerequisite for the clinical pharmacology course. It does not make sense to duplicate such obvious skill which is taught during another course.

The following learning of the current WKMOMU programme is: "*student should conduct the rational choice and prescription of drugs for therapeutic diseases, taking into account clinical and economic efficiency, depending on specific clinical situations and comorbidity*". Considering the necessary correction of the Russian text translation, we are surprised why a student should perform the rational choice and prescription of drugs only for internal diseases but not for neurology, surgery and so on. From another point of view, this learning outcome is not sufficiently precise and because of this it is very difficult to verify whether a student really has the ability to do it in all clinical cases for all potential diseases.

Some other learning outcomes, "*a student should estimate methods for the correction of undesirable adverse reactions of drugs; should estimate conclusions on the analysis of the rationality of pharmacotherapy*" are rather not clearly expressed. Drug-induced adverse effect may be prevented (if possible) or their results may be corrected. We suppose that it is again the effect of incorrect translation because in Russian it states: " оценить прогноз развития нежелательных побочных реакций лекарственных средств", which is much clearer and more reasonable.

We found also some learning outcomes defined as student's skills which are useless for the clinical pharmacology programme: "*skills of actively participate in discussions, conferences and other forms of continuous professional development; effectively provide the results of their activities (abstracts, presentations, etc.)"* The clinical pharmacology programme, as their authors put in the syllabus, prepares physicians but not scientific researchers.

As a summary, it should be stated that learning outcomes are described in the current programme only in very general terms. National Qualification Framework, in accordance with the Bologna Process, requires a very precise description of learning outcomes with clear indication of the way they will be achieved. PUMS experts have been informed by WKMOMU specialist on clinical pharmacology prof. Gaziza Smagulova that National Qualification Framework in the Republic of Kazakhstan are unavailable and are only being prepared.

Type of classes which are considered for the clinical pharmacology programme at WKMOMU are: practical classes, student's own work under teacher's control, student's individual work, but there are no lectures. In our opinion there a many complex subjects in the clinical pharmacology course which should be explained during a lecture, i.e. "The principles of pharmacotherapy of chronic and acute pain" or "The current indications and therapeutic schemes for the use of agents affecting coagulation".

It is also not acceptable that lot of very essential topics for clinical practice are not discussed with a teacher and are left only for student self-education. They are: "*Basic principles of evidence-based medicine. Criteria of evidence; Clinical and pharmacological approaches to the selection*

and use of drugs for diseases of the hematopoietic system (IDA and B12 - deficiency anemia); Clinical and pharmacological approaches to the selection and use of drugs for diseases of the endocrine system (diabetes mellitus, hypothyroidism, hyperthyroidism); Clinical and pharmacological approaches to the selection and use of drugs for diseases of the urinary organs (chronic pyelonephritis, chronic cystitis); Clinical and pharmacological approaches to the selection and use of drugs for diseases of the digestive system (gastric ulcer and duodenal ulcer)". In our opinion, it is not easy enough for a student to understand the principles and significance of evidence-base medicine (EBM) for their practice in future. The proper interpretation and use of data from EBM are obligatory to the choice of the most effective and safest pharmacotherapeutic options.

Table 1. The detail review of the current clinical pharmacology programme at WKMOMU
T*he text in italic originates from the clinical pharmacology programme at WKMOMU*.
Our comments indicating the lacking elements are highlighted in bold:

Topic of lessons Incorrect translation: classes not lessons	*Basic questions of the topic*	*Knowledge* *Skills* *Habits*	Hours
PL Introduction to clinical pharmacology. The basics of clinical pharmacology. Clinical pharmacodynamics. Clinical pharmacokinetics	*The purpose and objectives of clinical pharmacology* This question is necessary but should be followed by a discussion of modern principles of rational drugs prescribing. *2. The concept of pharmacokinetics and pharmacodynamics* The concept of pharmacokinetics and pharmacodynamics was discussed in basic pharmacology. It does not make sense to start again from scratch. *3. Evidence-based medicine: importance for rational pharmacotherapy.*	*Knowledge:* *To formulate modern principles of clinical pharmacology and the process of rational pharmacotherapy.* *Skills:* *Interpret the results of instrumental and laboratory methods of examination in patients.* This skill has no relationship with the programme content for this	4

LIWT *Selection of rational pharmacotherapy. Interpretation of data from instrumental and laboratory examination methods.*	*1. Clinical criteria for the effectiveness and safety of pharmacotherapy* *2. Laboratory and instrumental criteria for the effectiveness and safety of pharmacotherapy.* This programme content should be completed by a student during the other two courses - laboratory diagnostics and visual diagnostics. It constitutes the base for studying clinical pharmacology but it is not its issue.	practical class. Moreover, it belongs to a quite different course, such as laboratory diagnostics and visual diagnostics, which should be passed by a student before the clinical pharmacology course. *Abilities:* *Prescribe rational treatment according to the protocols.* This skill is not achievable after 6 hours of classes that do not cover even the most essential issues of clinical pharmacology.	2
PL Drug Interactions. Side effects of drugs. Monitoring of side effects of drugs.	*1 Types of drug interactions (pharmaceutical, pharmacokinetic and pharmacodynamic)* This question is very essential but cannot be limited only to the basic classification of drug-to-drug-interactions. This class should also cover clinical classification of drug-to-drug interactions. *2. The interaction of drugs with food, alcohol and components of tobacco smoke.* *3. Risk factors for drug interactions.* *4. Epidemiology of Unwanted adverse reactions (UAR)* *5. Classification and risk*	*Knowledge* *To formulate the basic principles of pharmacotherapy in the interaction of drugs and the concept of unwanted adverse reactions and the principles of monitoring side effects.* *Skills:* *Interpret the results of instrumental and laboratory methods of examination in patients.*	4

	factors for the development of UAR and the importance of polypharmacy *6. Diagnosis of UAR: Naranjo scale*	This skill is only a basic tool for starting the pharmacology course. It should not be mentioned as a learning outcome because it does not make sense. *Abilities:* *Use www.Drugs.com; www.medscape.com for the efficacy and safety of pharmacotherapy.* The use of these two medical bases does not require special abilities because it is technically extremely simple, however the proper interpretation of results received is a really desired ability.	
LIWT *Interpretation of data from instrumental and laboratory examination methods in the interaction of* drugs.	*1. Clinical criteria for the effectiveness and safety of pharmacotherapy* *2. Laboratory and instrumental criteria for the effectiveness and safety of pharmacotherapy*		2
PL *The process of rational prescribing of drugs in pregnant women, lactating women and the elderly.*	*Features of the pharmacokinetics and pharmacodynamics of drugs in pregnant, lactating women.* The problem of properties of pharmacokinetics/pharmacodynamic drugs characteristics in older people is lacking here. The Beers criteria, mentioned below, are only a type of summary of this topic. *2. The concept of drug categories, depending on the risk of adverse effects on the fetus by the FDA* *3. The concept of Beers criterion.*	*Knowledge:* *To formulate knowledge of the latest principles of pharmacotherapy used in pregnant, lactating women and the elderly.* *Skills:* *To interpret the results of instrumental and laboratory examination methods in pregnant, lactating women and the elderly.*	4

LIWT *Determination of the problem of pharmacotherapy in pregnant and lactating women (taking into account the peculiarities of prescribing drugs*	*1. Clinical criteria for the effectiveness and safety of pharmacotherapy in pregnant women, lactating women and the elderly.* *2. Laboratory and instrumental criteria for the effectiveness and safety of pharmacotherapy in pregnant women, lactating women and the elderly.*	This skill belongs to the laboratory diagnostics and visual diagnostics courses. *Abilities:* *Conduct pharmacotherapy in pregnant and lactating women according to the FDA category and the elderly according to the Beers criterion, according to clinical protocols.* It should be clearly stated which criteria are overriding for this ability: FDA/Beers or clinical protocols?	2
PL *Clinical and pharmacological approaches to the selection and use of drugs for diseases of the cardiovascular system – part 1 (hypertension, coronary heart disease)*	*Antihypertensive drugs: ACE inhibitors, angiotensin receptor blockers, calcium antagonists, beta-blockers, diuretics, centrally acting drugs.* It is not clear what is discussed during the practical class: pharmacology of these drugs? It should be done during the basic pharmacology course. *2. Antianginal drugs – nitrates and nitrate-like drugs, beta-blockers* It is not clear what is discussed during the practical class: pharmacology of these drugs? It should be done during the basic pharmacology course. *3. Hypolipidemic drugs.*	*Knowledge:* *To formulate the principles and processes of rational prescription of drugs for diseases of the cardiovascular system (HPT, IHD)* *Skills:* *Interpret the results of instrumental and laboratory methods of examination in patients.* This skill belongs to the laboratory diagnostics and visual diagnostics courses. *Abilities:*	4

	It is not clear what is discussed during practical class: pharmacology of these drugs? It should be done during the basic pharmacology course.	*Conduct rational treatment according to clinical protocols* Some clinical protocols in Kazakhstan are not modern enough. In our opinion, a student should know not only the clinical protocol but all modern medical possibilities.	
LIWT *Definition of the problem of treatment (drug and non-drug –* ? should be non-pharmacological) *in coronary heart disease, hypertension. Evaluation of drug performance* (? should be effectiveness) *criteria.* It does not make sense to talk about non-pharmacological treatment during the clinical pharmacology course. It should be discussed during the internal medicine course.	*1. The choice of appropriate drugs, dosages and duration of treatment. 2. Work with clinical protocols and drug instructions.* The analysis should include not only clinical protocols and drug instructions (the latter are not valuable in part, especially for older drugs). It should be based on EBM and scientific societies (Kazakh, European or American) recommendations. *3. Providing the patient with adequate information about adherence to treatment.*		2
PL *Clinical and pharmacological approaches to the selection and use of drugs for diseases of the cardiovascular system – part 2 (ACS, CHF, Heart rhythm disturbances)*	*1. Antiplatelet, anticoagulant drugs and thrombolytics* *2. Antiarrhythmic drugs.* *3. Potassium-sparing diuretics.* *4. Diuretics* It is not clear what is discussed during the practical class: pharmacology of these drugs? It should be done during the basic pharmacology course.	*Knowledge:* *To formulate the principles and processes of rational pharmacotherapy for diseases of the cardiovascular system (ACS,*	4

	Moreover, the list above does not include all groups of drugs used in the treatment of diseases mentioned.	*CHF, Cardiac rhythm disturbances)* It should be well defined what kind of arrhythmia pharmacotherapy is included in the programme.	
LIWT *Definition of the problem of treatment (drug and non-drug) in heart failure, CRD. Evaluation of drug performance* (? Should be effectiveness) *criteria* It does not make sense to talk about non-pharmacological treatment during the clinical pharmacology course. It should be discussed during the internal medicine course.	*1. The choice of appropriate drugs, dosages and duration of treatment. 2. Work with clinical protocols and drug instructions.* The analysis should not include only clinical protocols and drug instructions (the latter are not valuable in part, especially for older drugs). *3. Providing the patient with adequate information on treatment adherence*	*Skills:* *Interpret the results of instrumental and laboratory methods of examination in patients.* This skill belongs to the laboratory diagnostics and visual diagnostics courses. *Abilities:* *Conduct rational treatment according to clinical protocols* Some clinical protocols in Kazakhstan are not modern enough. In our opinion, a student should know not only the clinical protocol but all modern medical possibilities.	2
PL *Clinical and pharmacological approaches to the selection and use of drugs for diseases of the musculoskeletal system of RA, DOA деформирующий остеоартроз*	*1.Nonsteroidal anti-inflammatory drugs* *2. Glucocorticosteroids* *3.Basic anti-inflammatory drugs* *4. Immunosuppressants* *5. Immunomodulators* It is not clear what is discussed during the practical class: pharmacology of these drugs?	*Knowledge:* *To formulate the principles and processes of rational pharmacotherapy for diseases of the musculoskeletal system of RA, DOA*	4

	It should be done during the basic pharmacology course.	*Skills:*	
LIWT *Determination of effective and safe methods of treatment (medicinal and non-medicinal) in patients with RA, DOA.* *Evaluation of drug performance* (? Should be effectiveness) *criteria* It does not make sense to talk about non-pharmacological treatment during the clinical pharmacology course. It should be discussed during the internal medicine course.	*1. The choice of appropriate drugs, dosages and duration of treatment. 2. Work with clinical protocols and drug instructions.* The analysis should include not only clinical protocols and drug instructions (the latter are not valuable in part, especially for older drugs). *3. Providing the patient with adequate information on treatment adherence*	*Interpret the results of instrumental and laboratory methods of examination in patients.* This skill belongs to the laboratory diagnostics and visual diagnostics courses. *Abilities:* *Conduct rational treatment according to clinical protocols* Some clinical protocols in Kazakhstan are not modern enough. In our opinion, a student should know not only the clinical protocol but all modern medical possibilities.	2
PL *Modern approaches to rational antibacterial therapy for infectious diseases* *– part 1*	*The basic principles of antibiotic use.* *2 Classification, MA*?, *AE* ?, *indications and contraindications.* *3 beta-lactam antibiotics* *4 Aminoglycosides* *5 tetracyclines* *6 Macrolides* *7 Linkosamides* *9 Glycopeptides* *10Polymyxins* It is not clear what is discussed during the practical class: pharmacology of these drugs?	*Knowledge:* *To formulate the principles and processes of rational antibiotic therapy for infectious diseases* It should be clearly stated what kind of principles are discussed during classes. *Skills:* *Interpret the results of instrumental and laboratory methods of examination in patients.*	4

	It should be done during the basic pharmacology course.	This skill belongs to the laboratory diagnostics and visual diagnostics courses.	
LIWT *Determination of effective and safe methods of treatment (drug and non-drug)* *in patients with gastrointestinal diseases (gastric ulcer and duodenal ulcer, chronic cholecystitis)* It does not make sense to talk about non-pharmacological treatment during the clinical pharmacology course. It should be discussed during the internal medicine course.	*1. The choice of appropriate drugs, dosages and duration of treatment. 2. Work with clinical protocols and drug instructions.* The analysis should include not only clinical protocols and drug instructions (the latter are not valuable in part, especially for older drugs). *3. Providing the patient with adequate information on adherence to treatment.*	*Abilities:* *Conduct rational treatment according to clinical protocols* Some clinical protocols in Kazakhstan are not modern enough. In our opinion, a student should know not only the clinical protocol but all modern medical possibilities.	2
PL *Modern approaches to rational antibacterial therapy for infectious diseases* *- part 2*	*Basic principles of antibiotic use.* *2 Classification, mechanism of action, AE, indications and contraindications.* *3. Quinols and fluoroquinolones* *4. Antibiotics of different groups (Chloramphenicol, Linezolid, Rifampicin, Fusidic acid, etc.)* *5. Sulfanilamides* (it should be sulfonamides) *6. Derivatives of nitroimidazoles* *7. Derivatives of nitrofuran*	*Knowledge:* *To formulate the principles and processes of rational antibiotic therapy for infectious diseases* It should be clearly stated what kind of principles are discussed during classes. *Skills:* *Interpret the results of instrumental and laboratory methods of examination in patients.* This skill belongs to the laboratory diagnostics and	4

	8. Derivatives of 8-hydroxyquinoline It is not clear what is discussed during the practical class: pharmacology of these drugs? It should be done during the basic pharmacology course.	visual diagnostics courses. *Abilities:* *Conduct rational treatment according to clinical protocols* Some clinical protocols in Kazakhstan are not modern enough. In our opinion, a student should know not only the clinical protocol but all modern medical possibilities.	
LIWT *Determination of effective and safe methods of treatment (medicinal and non-medicinal). in patients with pneumonia, chronic bronchitis. Evaluation of criteria for the effectiveness of drugs.* It does not make sense to talk about non-pharmacological treatment in the case of bronchitis or pneumonia. It is not a significant element of the therapy of these diseases. Moreover, chronic bronchitis by itself is not an infectious disease. It should be stated: exacerbation of chronic bronchitis	*1. The choice of appropriate drugs, dosages and duration of treatment. 2. Work with clinical protocols and drug instructions.* The analysis should include not only clinical protocols and drug instructions (the latter are not valuable in part, especially for older drugs). *3. Providing the patient with adequate information on treatment adherence*		2

in the course of COPD. It should be also marked, that, in this schedule, antiviral, antiprotozoal and drugs used in the therapy of TBC are not included.			
PL *Clinical and pharmacological approaches to the selection and use of drugs for diseases of the lower respiratory tract: Pneumonia, chronic bronchitis, COPD,* *BA.* Taking into consideration drugs mentioned in the next column it should be noted that these drugs (except expectorants) are not used for pneumonia. It does not make sense to discuss the treatment of asthma or COPD together with the pneumonia treatment.	*1 beta adrenomimetics* *2.Muscarinocholin blockers* *3. Methylxanthines.* *4. Inhalation and systemic glucocorticosteroids* *5. Leukotriene inhibitors* *6. Mast cell membrane stabilizers.* *7 Expectorant preparations* It is not clear what is discussed during the practical class: pharmacology of these drugs? It should be done during the basic pharmacology course.	*Knowledge:* *To formulate the principles and processes of rational pharmacotherapy for diseases of the lower respiratory tract.* *Skills:* *Interpret the results of instrumental and laboratory methods of examination in patients.* This skill belongs to the laboratory diagnostics and visual diagnostics courses. *Abilities:* *Conduct rational treatment according to clinical protocols* Some clinical protocols in Kazakhstan are not modern enough. In our opinion, a student should know not only the clinical protocol	4
LIWT Determination of effective and safe methods of	*1. The choice of appropriate drugs, dosages and duration of treatment. 2. Work with clinical protocols and drug*		2

treatment (drug and non-drug) in patients with COPD, BA.	*instructions.* The analysis should include not only clinical protocols and drug instructions (the latter are not valuable in part, especially for older drugs). *3. Providing the patient with adequate information on treatment adherence*	but all modern medical possibilities.	
PL *Clinical and pharmacological approaches to the selection and use of drugs for pain*	*The main principles of the use of opioid and non-opioid analgesics.* *2. Classification, Mechanism of action, SE, indications and contraindications.* It is not clear what is discussed during the practical class: pharmacology of these drugs? It should be done during the basic pharmacology course. *3. The main principles of treatment of pain.* *4. Problems of opioid resistance.*	*Knowledge:* *To formulate modern principles of pharmacotherapy and the process of rational pharmacotherapy for pain* *Skills:* *Interpret the results of instrumental and laboratory methods of examination in patients.*	4
LIWT *Determination of the treatment problem for pain*	*1. The choice of appropriate drugs, dosages and duration of treatment. 2. Work with clinical protocols and drug instructions.* The analysis should include not only clinical protocols and drug instructions (the latter are not valuable in part, especially for older drugs). *3. Providing the patient with adequate information on treatment adherence*	This skill belongs to the laboratory diagnostics and visual diagnostics courses. *Abilities:* *Conduct rational treatment according to clinical protocols* Some clinical protocols in Kazakhstan are not modern enough. In our opinion, a student should know not only the clinical protocol	2

		but all modern medical possibilities.	

Types of classes at WKMOMU: practical classes; student's own work under teacher's control; student's individual work (student's self-education), there are no lectures.

The current programme on clinical pharmacology at WKMOMU covers in total 120 hours including:

lectures: 0 hours

practical classes: 40 hours

student's own work under teacher's control: 20 hours

student's individual work: 60 hours

ECTS - 4

There is a significant error in the calculation and distribution of teaching hours:

A half of didactic hours are "student's individual work" (student's self-education)

Comment:

Unfortunately, during on-line meeting PUMS experts noticed that the head of the Department of Academic Work at WKMOMU used the misinterpreted issue of the term "student's independent work" basing on the document titled "Organization of educational process under credit technology of education in the Republic of Kazakhstan in accordance with the Order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 no. 152 .On approval of the Rules of the educational process organization under credit technology of education.

The paragraph 25 of this documents sounds: "In credit technology of education, students' independent work is divided into two parts: an independent work, which is carried out under the guidance of a teacher (Student's Independent Work with a Teacher), and the part that is completely independent (Student's Independent Work itself)". This paragraph really suggests that the part of each course material students should study absolutely themselves with any help from the teacher, however is absolutely false interpretation of European Credit Transfer and Accumulation System (ECTS).

According to ECTS, the workload of a student is an estimation of the time needed to complete all learning activities such as lectures, seminars, projects, practical work and individual study required to achieve the defined learning outcomes in formal learning environments and what will be evidenced by appropriate assessment. It is time for the analysis and study of the whole material completed during contact learning activities.

Moreover, in the current WKMOMU curriculum regarding clinical pharmacology, many important issues are included in the misinterpreted scope of student's individual work. It is unacceptable to skip the essential topics, such as the treatment of endocrine diseases, including

diabetes mellitus, treatment of anemia, the use of growth factors, treatment of infections, as well as pharmacogenetic, pharmacoeconomic and pharmacoepidemiological issues.

Since the misinterpreted document (cited above) was edited by the Minister of Education and Science of the RK, its proper interpretation should be corrected by this institution, because the continuation of a ETCS misinterpretation leads and will further lead to the decreased level in the education of students, including pharmacology courses both types: basic and clinical.

The current WKMOMU clinical pharmacology course syllabus recommends the following literature.

T*he text in italic originates from the clinical pharmacology programme at WKMOMU*.
Our comments are given in bold.

1. Clinical Pharmacology: Textbook / Ed. V.G. Kukes .-- 3rd ed. reslave. and add., 4th ed. reslave. and add. - M .: GEOTAR-MED, 2006, 2008, 2009. - 944-1054p. Unacceptable old edition of the textbook

2. Clinical pharmacology: national leadership + SD. / Ed. Yu.B. Belousov et al. - M.: GEOTAR-Media, 2009 .-- 976 p. Unacceptable old edition of the textbook

3. Clinical pharmacology according to Gilman and Goodman: in 4 books ../ ed. A.G. Gilman. - M.: Practice, 2006, 520p.-336p.-400p.-448p. Unacceptable old edition of the textbook

4. Clinical pharmacology and pharmacotherapy: textbook / V.G. Kukes, A.K. Starodubtsev.- 2nd ed. corrected - M .: GEOTAR-MED, 2006 .— 640p. Unacceptable old edition of the textbook

Additional references:

1. Kalieva Sh.S. Clinical pharmacology and rational pharmacotherapy: textbook, T.1 / Sh. S. Kaliev, N.A. Minakova. - Almaty: Evero, 2014.464p Cannot be assessed

2. A practical guide to anti-infectious chemotherapy / Edited by L.S. Strachunsky, Yu.B. Belousova, S.N. Kozlova // webmaster @ antibiotic.ru Cannot be assessed

4. Mashkovsky M.D. Medicines, Part 1.2 / M.D. Mashkovsky. - Kharkov 2009. – 1200p. Unacceptable old edition

6. N. Ormanov. Pharmacotherapy: textbook, 1-book / N.Z. Ormanov, L.N. Ormanova-Almaty: Evero, 2012.-500 p. Unacceptable old edition

7. N. Ormanov. Pharmacotherapy: textbook, 2-book / N.Z. Ormanov, L.N. Ormanova-Almaty: Evero, 2012.-352 p. Unacceptable old edition

8. Russian-Kazakh medical pharmacological dictionary: 19000 words / Ed .: G.D. Berdimratova., Kozdenbaeva.-Almaty, 2006.-608p. Unacceptable old edition

9. Fundamentals of pharmacotherapy and clinical pharmacology: textbook / ed .: M.D. Gay, V.I. Petrov.-3- ed., reslave. and add. –Rostov n / A: Phoenix, 2010.-800 p. Unacceptable old edition

10. Rakhimov K. D. Clinical pharmacology: textbook / K.D. Rakhimov.-Almaty, 2014.-406 p. Cannot be assessed

9. Appendices: Map of the discipline supply with teaching materials (attach a document issued by the library)

Conclusion: the programme and, in consequence, the syllabus for the clinical pharmacology course for undergraduate students at WKMOMU requires deep reconstruction and modernization.

II. DESCRIPTION OF THE PROPOSAL OF THE NEW CLINICAL PHARMACOLOGY PROGRAMME FOR WKMOMU UNDERGRADUATE STUDENTS

II.1. Objective

The objective of a clinical pharmacology course is to provide the student with knowledge of the clinical pharmacology of essential drugs and with adequate skills in order to enable them to become competent in the rational (safe and effective) prescription of drugs in all areas of clinical practice.

Nevertheless, the importance of clinical pharmacology issues should be considered also in all clinical courses such as internal medicine, paediatrics, surgery, obstetrics and gynaecology, dermatology, laryngology, intensive care, and many others. During these clinical courses, there are continuous opportunities to observe and appraise critically the patient drug charts in the context of Evidence Base Medicine and clinical protocols, to see the therapeutic and adverse effects of drugs and to practice relevant skills (e.g. prescribing, dose calculations, drug preparation and administration, and searching for good quality information to inform prescribing decisions). Therefore, the clinical pharmacology course at WKMOMU should be constructed as collaboration of all authors of other clinical courses at WKMOMU [7,8], including especially internal medicine, surgery, pediatrics, obstetrics and gynecology, general practice (family medicine).

II.2. Proposal for National Qualification Frameworks

The National Qualification Frameworks are a document usually provided by a governmental institution (e.g. ministry) managing education. The development of national qualifications frameworks also reflects the Bologna Process and the agreement to implement qualification frameworks in the area of higher education. Frameworks help to make qualifications easier to understand and compare. National qualification frameworks classify qualifications by level, based on learning outcomes. This classification reflects the content and profile of qualifications - that is, what the holder of a certificate or diploma is expected to know, understand, and be able to do.

We had no chance to see such document being in force in the Republic of Kazakhstan, therefore we provide our proposition for clinical pharmacology learning outcomes based on the current scientific literature [8-11] and our own experience.

The core content of a curriculum in clinical pharmacology should be focused on emphasis on critical drug evaluation. Learning outcomes should be generic requirements for the safe and effective use of drugs in all areas of clinical practice. It should be emphasized that clinical pharmacology course for undergraduate students should give them ability to understand the basic principles of clinical pharmacology allowing physicians to take a logical approach to learning about any of the drugs they will encounter during their practice. The aim of the course is to form a physician who is a competent practitioner, but not a scientist or supervisor in the discipline of clinical pharmacology [9-12].

II.3. Syllabus for the clinical pharmacology programme

II.3.1. Entry requirements

Basic pharmacology, internal diseases, surgery, paediatrics, obstetrics and gynaecology.

II.3.2. Learning outcomes

Learning outcomes have to be described more precisely and clearly than it was done in the current WKMOMU curriculum.

Knowledge and understanding

Student

- recognizes the importance of clinical pharmacology as the scientific discipline that underpins a rational approach to prescribing medicines
- has knowledge of basic pharmacokinetic and pharmacodynamic principles
- knows the common inducers and inhibitors of CYP450 liver enzymes
- has a basic understanding of how drugs work: their mechanisms of action to produce not only therapeutic effects but also adverse effects
- has basic knowledge of basic pharmacogenetics and chronopharmacology
- has working knowledge of various sources of drug information including local prescribing guidelines, summary of product characteristics, recommendations of scientific societies
- knows how to use local formularies (i.e. protocols)
- knows about the drug management of common illnesses
- knows of pharmacological principles to use, devise or advise on appropriate dosing regimens to optimize drug effects
- knows the considerations that need to be made when prescribing for patients with renal or hepatic dysfunction
- knows the considerations that need to be made when prescribing for pregnant or breastfeeding women

- knows the considerations that need to be made when prescribing for geriatric and paediatric patients
- knows the commonly prescribed medicines that require therapeutic drug monitoring (TDM)
- knows about the existence of systems for reporting actual or suspected adverse drug effects
- knows substances which can cause drug dependence and symptoms of drug-dependence

Skills

Student

- is able to apply basic pharmacokinetic and pharmacodynamic principles
- is able to write a clear, legible, unambiguous prescription
- is able to take drug history
- is able to prescribe rationally in individual patients
- is competent and confident in performing pharmaceutical and dosage calculations
- is able to explain the need for performing therapeutic drug monitoring (TDM)
- is able to choose the proper route and device for drug administration (i.e. infusion pump, IV bolus)
- is able to use treatment protocols
- is able to predict and manage common potential drug interactions including those caused by non-prescribed, herbal or complementary medication
- is able to identify suspected or actual adverse drug reactions
- is able to prescribe drugs commonly used to manage acute emergencies
- is able to counsel patients on commonly prescribed drugs
- is able to identify possible causes of non-adherence
- is able to anticipate (and hence minimize), detect, manage, report possible drug prescription or administration errors
- is able to advise on cases of overdose or poisoning, and to manage such cases
- is able to recognize drug-dependence
- is able to assess the validity of new drugs

Competencies

Student

- practices evidence-based prescribing with adequate, up-to-date awareness of drugs actions, their indications, dose, contraindications, interactions, cautions, and side effects
- writes legible, unambiguous, and complete prescriptions that meet legal requirements
- accurately calculates doses and routinely checks calculations where relevant
- provides patients with appropriate information about their medicines

- explains the rationale behind, and the potential risks and benefits of management options
- accesses reliable information about medicines
- detects and reports adverse drug reactions
- uses properly local formularies (protocols)
- knows and applies legal and ethical frameworks affecting the prescribing practice

These core clinical pharmacology learning objectives can be linked to a number of specific drugs and therapeutic problems which might be used to provide relevant clinical examples of the principles of clinical pharmacology in practice [9-12].

II.3.3. Topics of lectures and practical classes.

Lectures

1. Factors that determine the inter-individual variation in drug response (adherence to therapy, pharmacodynamic variation, pharmacokinetic variation, pharmacogenetic variation, chronopharmacology, pharmaceutical variation)
2. Monitoring drug therapy (the importance of monitoring the effect of drug therapy, the ways in which this can be achieved, measuring plasma drug concentrations or assessing pharmacodynamic responses, the variable relationship between drug dose, plasma concentration and clinical effect)
3. Adverse drug reactions (the types of ADRs, the frequency, recognition of common susceptibility factors and how risks can be minimized, the importance of reporting adverse reactions and other approaches to pharmacovigilance)
4. Drug–drug interactions (the mechanisms by which drugs interact, the clinical significance, the ways in which interactions can be predicted and avoided). Medication errors (the different types, the common reasons, the ways in which individual prescribers can reduce the risk of medication errors)
5. Clinical drug toxicology (the assessment, recognition and treatment of common intoxications, the principles of removing or counteracting the effects of toxic substances, toxicokinetic and toxicodynamics)
6. Prescribing for special patient groups (elderly patients, children, pregnant women, breastfeeding women, patients with renal or liver disease)
7. Analysing new evidence (practicing evidence-based prescribing, assessing the validity of evidence presented on new drugs or therapies)

Practical classes

1.Legal aspects of prescribing drugs (concerning local law and regulations). Managing the prescribing of medicines (the role of local formularies, the role of drug and therapeutics committees, the rational assessment of new drugs based on safety, efficacy and cost-effectiveness)
2. Taking a drug history (taking accurate information about current prescription and non-prescription drugs, making an assessment of adherence to a medication regimen, recording current and past adverse effects). Drug information (acquisition of knowledge on and practice in how to assess the value and reliability of drug information sources)
3. Prescribing drugs in special groups (elderly, children, pregnancy and breastfeeding, renal and liver failure). Adverse drug reactions and interactions (assessing drugs as a possible cause of symptoms and signs, recognizing the potential for adverse interactions, reporting ADRs and interactions). Monitoring drug therapy (identifying which therapeutic effect to observe, using measurements of plasma drug concentrations appropriately, acting appropriately with the results.
4-10.The principles of pharmacotherapy of common diseases and/or syndromes (drugs used, therapeutic schemes, duration of therapy, necessary monitoring, choosing a safe and effective drug and an appropriate dose, writing accurate, legible and legal prescriptions, calculation of drug, calculation of the strength of an infusion based on the required rate of drug administration, selecting the appropriate route of administration).

- coronary heart disease, heart failure, hypertension, atrial fibrillation, ventricular tachycardia, cardiac arrest, antithrombotic prophylaxis
- peptics ulcer, diarrhoea, vomiting
- asthma, COPD
- diabetes mellitus, suprarenal insufficiency, renal failure – chronic and acute
- pain - chronic and acute
- infections (pneumonias, erysipelas, meningitis, urinary tract infections)
- emergencies (cardiac arrest, anaphylactic shock, pulmonary oedema, myocardial infarction, ventricular tachyarrhythmia, atrial fibrillation, acute renal insufficiency, hypoglycaemic coma, exacerbation of asthma or COPD)

11. Intoxication with gases, pesticides, heavy metals, biological toxins (animal, plant-origin), organic solvents, drugs overdosing and intoxication. Symptomatology (toxidromes), mechanism and first aid + antidotes [9-14].

II.4 Teaching and learning methods.

Context-learning - learning in a setting that is similar to the setting of the future profession. Context-learning is based on four basic principles: setting, repetition, feedback, responsibility. The setting - the clinical setting, such as in primary health care, hospitals or nursing homes.

Subsequently, students should be given the opportunity to repeat the therapeutic problem-solving process as much as possible. Students should also receive feedback. Argumentation and motivational feedback may be a rapid way to reveal the process of therapeutic thinking and its possible errors. Students should be responsible for their own learning. It is the student's own responsibility to repair any lack of knowledge or skills discovered during their clinical work and feedback sessions.

Medical simulation

Medical simulation plays a very important role in teaching clinical pharmacology. Scenarios concerning especially emergencies (e. g. pulmonary oedema, myocardial infarction, ventricular tachyarrhythmia, atrial fibrillation, acute renal insufficiency, hypoglycaemic coma, exacerbation of asthma or COPD) may be very helpful in safe training of problems of clinical pharmacology.

As we know, the medical simulation centre is well developed in WKMOMU, however the use of scenarios mentioned above requires more advanced simulators. PUMS experts offered the sharing of some scenarios developed and used at PUMS.

Clinical correlations/case studies

Clinical correlations and case studies should be included in this course to offer a preview of how the basic pharmacology of specific drugs relates to clinical practice. A case history should be presented, and students will be asked to discuss and make decisions related to diagnosis, treatment options and expected outcomes [7-14].

II.5 Testing and assessment

The purpose of testing is to provide means of evaluating student's knowledge and skills.

Questions may be based on content covered in any class session, including lectures, simulations, case studies and other practical classes content.

There will be two credit tests and a final examination.

Clinical pharmacology questions will be short-answer, multiple-choice, single-choice or matching "drag and drop" or "false-true".

Student might be asked to calculate pharmacokinetic parameters or to interpret clinical, graphical or tabular data. Matching and multiple-choice questions may have up to ten selections from which you must choose the single best answer.

Students should expect the questions to become increasingly complex.

For all intents and purposes, the content of the required textbook and other ancillary material that might be provided define the minimal limits of testable material for this course.

Questions will be based on the learning objectives provided to you for each topic.

Except testing, students will be assessed during the practical class on the basis of their ability to solve problems discussed.

OSCE exams are much required, an ideal exam type for clinical pharmacology [7-14].

III. THE LIST OF ESSENTIAL DRUGS USED FOR ESSENTIAL DISEASES AND/OR SYNDROMES OR SYMPTOMS – THE PHARMACOLOGY OF THESE AGENTS SHOULD BE KNOWN TO A STUDENT.

Agents used for coronary heart disease (antianginals)

- ✓ Glyceryl trinitrate, isosorbide di- (or mono-)nitrate
- ✓ Beta-receptor blocking drugs (nebivolol, metoprolol, bisoprolol, carvedilol)
- ✓ Calcium channel blockers (amlodipine, lacidipine, lercanidipine; verapamil, diltiazem)
- ✓ ACE-inhibitors (ramipryl, perindopril)
- ✓ Ivabradine

Agents used for hypertension

- ✓ Thiazide and thiazide-like diuretics (hydrochlorotiazide, indapamide)
- ✓ Beta-receptor blocking drugs (metoprolol, bisoprolol, carvedilol)
- ✓ Calcium channel blockers (amlodipine, lacidipine, lercanidipine)
- ✓ ACE-inhibitors (ramipryl, perindopril, lisinopril)
- ✓ Angiotensin 1 (AT-1) receptor antagonists (telmisartan, valsartan, losartan)
- ✓ Centrally acting drugs (clonidine, methyldopa)
- ✓ Imidazole receptor agonists (rilmenidine)
- ✓ Alpha-receptor blocking drugs (tamsulosin, doxazosin)
- ✓ Vasodialtors (sodium nitroprusside, hydralazine)
- ✓ Drugs for hypertensive emergencies (esmolol,labetalol, urapidil)

Agents used for heart failure

- ✓ Loop diuretics (furosemide, torsemide)
- ✓ ACE-inhibitors (ramipryl, perindopril, lisinopril)
- ✓ Cardiac glycosides (digoxin)
- ✓ Beta-receptor blocking drugs (metoprolol, bisoprolol, carvedilol)
- ✓ Sympathomimetics (dopamine, dobutamine)
- ✓ Calcium sensitizers (levosimendan)
- ✓ Phoshodiesterase III inhibitors (milrinone)
- ✓ Others (nesiritide, sacubitril, ivabradine)

Agents used for arrhythmia

- ✓ Class I (quinidine, lidocaine, propafenone)
- ✓ Class II - beta-receptor blocking drugs (esmolol, metoprolol, bisoprolol, propranolol)
- ✓ Class III (sotalol, amiodarone)
- ✓ Class IV - calcium channel blockers (verapamil, diltiazem)
- ✓ Other (adenosine, digoxin)

Anticoagulants, antiplatelet agents, fibrynolytics for therapy and prophylaxis

- ✓ Heparin – low molecular weight (enoxaparin); heparin, sodium
- ✓ Anti-vitamins K (warfarin, acenocoumarol)

- ✓ Direct oral anticoagulants (DOAC – rivaroxaban, apixaban, dabigatran)
- ✓ Antiplatelet agents (acetylsalicylic acid, clopidogrel, prasugrel,ticagrelor,abciximab)
- ✓ Fibrinolytics (streptokinase, alteplase)

Agents used for hyperlipoproteinemias

- ✓ Statins (atorvastatin, simvastatin,rosuvastatin)
- ✓ Fibrates (fenofibrate,gemfibrozil)
- ✓ Inhibitor of cholesterol absorption (ezetimibe)
- ✓ Convertase subtilisin kexin type 9 (PCSK9) inhibitor (evolokumab)
- ✓ Ion-exchange resins (cholestyramine)

Agents used for pain relief

- ✓ Non-opioid analgesics (paracetamol, metamizole)
- ✓ Non-steroidal anti-inflammatory drug (ibuprofen, diclofenac, meloxicam, celecoxib)
- ✓ Opioids (codeine, tramadol, morphine, buprenorphine, fentanyl, tapentadole, petidine)
- ✓ Agents for neuropatic pain (gabapentine, pregabalin, carbamazepine, amitriptyline, lidocaine)
- ✓ Agents used for colic pain (hyoscine, drotaverine, papaverine)
- ✓ Anti-migraine drugs (sumatriptan)

Agents used for general anesthesia

- ✓ Inhalation agents (N_2O, enflurane, isoflurane, sevoflurane, halotane)
- ✓ Thiopental
- ✓ Propofol
- ✓ Ketamine
- ✓ Muscle relaxants (pancuronium, atracurium, suxamethonium)

Agents used for local anesthesia

- ✓ Lidocaine
- ✓ Bupivacaine
- ✓ Benzocaine
- ✓ Tetracaine

Agents used as anxiolytics and/or hypnotics

- ✓ Benzodiazepines (alprazolam, midazolam, diazepam, oxazepam, estazolam)
- ✓ Non-benzodiazepine hypnotics (zolpidem, zaleplone)

Agents used for epilepsy

- ✓ Carbamazepine
- ✓ Hydantoin derivatives (phenytoin)
- ✓ Valproic acid
- ✓ Ethosuximide
- ✓ Phenobarbital
- ✓ Topiramate

- ✓ Levetiracetam
- ✓ Gabapentin

Agents used for psychoses

- ✓ Classical neuroleptics (chlorpromazine, haloperidol, levomepromazine)
- ✓ Atypical neuroleptics (clozapine, olanzapine, aripiprazole)

Agents used for depression and bipolar disease

- ✓ Tricyclic antidepressants (amitriptyline, imipramine)
- ✓ Lithium
- ✓ Serotonin-reuptake inhibitors (sertraline,fluoxetine, citalopram, escitalopram)
- ✓ serotonin-norepinephrine reuptake inhibitor (venlafaxine, duloxetine)
- ✓ inhibitor of norepinephrine and dopamine reuptake (bupropion)
- ✓ Inhibitors of MAO-A (moclobemide)
- ✓ Alpha2, 5HT2, 5HT3 -receptor antagonists (mianserine)
- ✓ Norepinephrine- reuptake inhibitors (reboxetine)
- ✓ Others (tianeptine, aglomelatine)

Agents used for Parkinson disease

- ✓ Levo-dopa+carbidopa
- ✓ Dopa-decarboxylase inhibitors (benserazide)
- ✓ Anticholinergic drugs (biperiden)
- ✓ Monoamine-oxidase inhibitors (selegiline)
- ✓ Others (entacapone,amantadine)

Agents used for infections

- ✓ Penicillins (penicillin V and G, amoxycillin, flucloxacillin, amoxycillin + clavulanic acid, piperacillin+tazobactam, carbenicillin)
- ✓ Cephalosporins (cefalexine, cefuroxime, ceftriaxone, ceftazidime, cefepime)
- ✓ Carbapenems (imipenem, meropenem)
- ✓ Monobactams (aztreonam)
- ✓ Macrolides (erythromycin, clarithromycin, azithromycin)
- ✓ Ketolides (telithromycin)
- ✓ Lincosamides (clindamycin)
- ✓ Tetracyclines (doxycycline)
- ✓ Glycylcyclines (tigecycline)
- ✓ Glycopeptides (vancomycin)
- ✓ Imidazole derivatives (metronidazole)
- ✓ Aminoglycosides (gentamycin, amikacin)
- ✓ Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin)
- ✓ Sulfonamides (co-trimoxazole)
- ✓ Chloramphenicol

- ✓ Nitrofurantoin
- ✓ Rifaximine
- ✓ Phosphomycin
- ✓ Tuberculostatics (isoniaside, ryfampin, ethambutol, pyrazinamide, streptomycin)
- ✓ Antiviral agents (aciclovir, zidovudine, lamivudine, abacavir, efavirenz, ritonavir, enfuvirtide, maraviroc, ribavirin, raltegravir, oseltamivir daklatasvir, interferon alfa)
- ✓ Antifungals (amphotercin B, nystatin, ketoconazole, fluconazole, voriconazole, terbinafine, griseofulvin)
- ✓ Antimalarial agents (chloroquine, mefloquine, atovaquone, proguanil, primachine, pyrimetamine, lumefantrine)
- ✓ Antihelmintics (albendazole, mebendazole, pyrantelum)

Agents used for asthma and/or COPD + antitussive/mucolytic agents

- ✓ Glucocorticoids, inhaled (beclomethasone, budesonide, ciclezonide)
- ✓ Glucocorticosteroids systemic (prednisone, hydrocortisone)
- ✓ $Beta_2$-agonists (salbutamol, salmeterol, formoterol, vilanterol)
- ✓ Cholinolytics inhaled (ipratropium, tiotropium, umeclidinium)
- ✓ Leukotriene antagonist (montelukast)
- ✓ Phosphodiesterase inhibitors (roflumilast, theophylline)
- ✓ Other (omalizumab, mepolizumab)
- ✓ Antitussive agents (dextromethorphan, butamirate)
- ✓ Mucolytics (acetylcysteine, ambroxol)

Agents used for peptic ulcer, vomities, diarrhea, constipation

- ✓ H2-antagonists (ranitidine)
- ✓ Proton pump inhibitors (omeprazole, dexlansoprazole, esomeprazole)
- ✓ Others used for peptic ulcer (misoprostol, sucralphate, bismuth subcitrate
- ✓ Agents used for vomities (metoclopramide, dimenhydrinate, odnasetron, aprepitant, glucocorticosteroids, haloperidol)
- ✓ Agents used for diarrhea (loperamide)
- ✓ Agents used for constipation (bisacodyl, antranoids, macrogols, lactulose, phosphates)

Diuretics

- ✓ Loop diuretics (furosemide, torsemide)
- ✓ Thiazide (hydrochlorothiazide)
- ✓ Spironolactons (spironolactone, eplerenone)
- ✓ Mannitol
- ✓ Carbonic anhydrase inhibitors (acetazolamide)

Drugs used for rheumatoid arthritis, drugs for osteoporosis and drugs for gout

- ✓ NSAIDs, methotrexate, sulphasalazaine, chloroquine, etanercept, infliximab, golimumab, abatacept

- ✓ pamidronate, zolendronate, raloxifene, bazedoxifene + estrogen conjugated, cholecalciferol, cinacalcet, teriparatide, strontium ranelate, denosumab, calcium, vitamin D
- ✓ allopurinol, febuxostate, colchicine, allopurinol

Drugs used for endocrine diseases

- ✓ levothyroxine, propylothiouracyl, methimazole, Natrii Iodidum - I^{131}
- ✓ metformin, gliclazide, pioglitazone, acarbose, liraglutide, sitagliptine, empagliflozin, bromocriptine, lispro, glargine, degludec, isophane insulin, regular insulin
- ✓ hydrocortisone, prednisone, methylprednisone, dexamethasone, fludrocortisone
- ✓ finasteride, leuproleine
- ✓ oral contraceptives and hormonal replacement therapy

Drugs used for anemia, granulocytopenia, thrombocytopenia

- ✓ iron preparations (ferrous sulphate), vitamin B12, folic acid, erythropoietin, dsarbopoetin
- ✓ filgrastim
- ✓ oprevelkin, romiplostim, eltrombopag

Drugs used in oncology

- ✓ Cytotoxic agents (cyclophosphamide, methotrexate, mercaptopurine, fluorouracil, cytarabine, vincristine, etoposide, paclitaxel, topotecan, doxorubicine, bleomycin, cisplatine, asparaginase)
- ✓ Monoclonal antibodies (rituximab, alemtuzumab, bevacizumab, trastuzumab, daratumumab, brentuximab vendotin)
- ✓ Targeted therapeutics (imatinib, sorafenib, thalidomide, bortezomib, vorinostat, tipifamib, bexarotene, tamoxifene, fulvestrant)
- ✓ Supportive agents (amifostine, dexrazoxane, folinic acid)

Drugs used as immunosupressants

- ✓ Glucocorticosteroids
- ✓ Mycophenolate mofetil
- ✓ Calcineurin inhibitors (cyclosporine, tacrolimus)
- ✓ Proliferation inhibitors (sirolimus, everolimus)
- ✓ Others (methotrexate, cyclophosphamide, azathioprine)

Drugs used in obstetrics and gynecology

- ✓ oxytocin, ergot derivatives, prostaglandins, beta-receptor sympaticomimetics, magnesium sulphate

Drugs used for allergy

- ✓ Antihistaminics (clemastine, cetirizine, loratadine, desloratadine)
- ✓ Glucocorticosteroids

Drugs used for emergencies

- ✓ glucocorticosteroids, atropine, amiodarone, epinephrine, glucose, labetalol, urapidil, salbutamol, furosemide, nitroglycerine, morphine

Antidotes

- ✓ carbo medicinalis, deferoxamine, penicillamine, DMPS, EDTA, hydroxycobalamine, fomepizol, methylenum coeruleum, ethanol
- ✓ flumazenil, naloxone, acetylsyteine, protamine suphate, vitamin k, calcium chloride, glucagon

For each of the drugs or its class, students might be expected to:

know its name and class; understand how it works; recognize the appropriate indication for its use; know how to prescribe it – how it is administered, the frequency of administration, the duration of administration; know its important contraindications, potential drug interactions, and major adverse effects; know how to monitor the drug's effects; be able to explain salient features of all of these points to a patient.

IV. Summary remarks

1. The suggested changes identify a number of practically important topics in clinical pharmacology which were absent in the WKMOMU curricula in force between 2019 and 2021.
2. The level of education for the undergraduate medical students in general (basic) pharmacology is good, although their education in clinical pharmacology must be improved in comparison to the current standards found at WKMOMU.
3. The European Credit Transfer and Accumulation System (ECTS) has been misused by the staff from the Department of Academic Work at WKMOMU. According to ECTS [15], the workload of a student is an estimation of the time necessary to complete all learning activities, such as lectures, seminars, projects, practical work and individual study required to achieve the defined learning outcomes in the formal learning environments, which will be substantiated by an appropriate assessment. This is the time to analyze and study the entire material covered during contact learning classes. The persistence of the ETCS misinterpretation will further decrease the level of learning, including both basic and clinical pharmacology courses.

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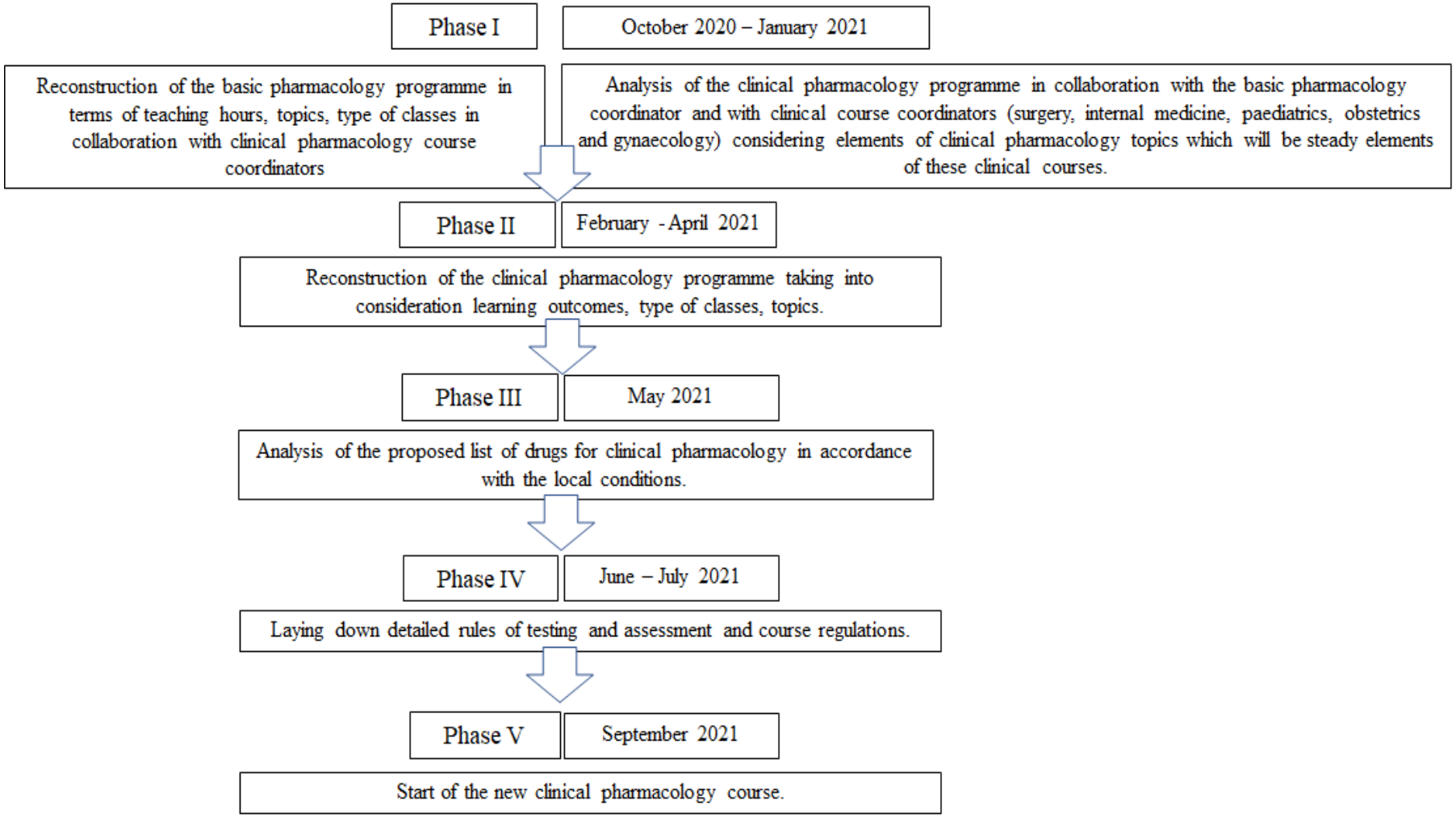
Attachment 2A1 – II

Road map for the insertion of the new programme into the education process at WKMOMU



Attachment 2B1 – I

The review and the proposal of the program in Oncology: Oncological Laboratory Diagnostics discipline for undergraduate students

I.INTRODUCTION

Laboratory diagnostics constitutes an essential element of modern clinical practice, and one of the most interdisciplinary specialties. Each graduate of the medical faculty must present a satisfactory knowledge and skills in the field of laboratory medicine.

According to the WHO, "In vitro diagnostic tests are used for in vitro examination of specimens derived from the human body to provide information for screening, diagnosis, or treatment purposes." Thus, as a discipline, laboratory diagnostics is a branch of medical diagnostics which deals with laboratory methods for the screening, diagnosis, or treatment monitoring.

The role of laboratory diagnostics in the modern healthcare system is to provide medical doctors with reliable, high-quality information relevant for the screening, diagnosis, or treatment monitoring.

Medical laboratory professionals/specialists are preferable to work in the clinical laboratory. Graduates of biology, chemistry, etc. faculties who have not been educated in pathophysiology and clinical biochemistry are not qualified to be the only staff for medical laboratories. Pathobiochemistry and pathophysiology, as well as knowledge and practice in the use of modern technology in laboratory testing, constitute the fundamental areas of education and training of the laboratory staff.

The basis for the laboratory diagnostics are methods comprising pre-analytical, analytical, and post-analytical processing of biological samples in the medical laboratory to obtain reliable medical information.

Laboratory diagnostics comprises several topics: hematology and coagulation, clinical chemistry (biochemistry), immunology, immunohematology and blood bank, cytology, microbiology, and molecular tests. Laboratory diagnostics includes pre-analytical, analytical, and post-analytical processing of biological samples, as well as the application of modern technologies for laboratory testing. Attributes of different laboratory methods are essential to apply the technique to clinical laboratory practice.

II. REVIEW OF LABORATORY DIAGNOSTICS (CLINICAL LABORATORY DIAGNOSTICS) CURRICULA AVAILABLE AT THE WKMOMU.

1. The current WKMOMU documents, a basis for the undergraduate educational program, do not present the detailed learning outcomes of the knowledge, skills, and competencies.
Therefore, it is not possible to control the coverage and fulfilment of the learning outcomes within the courses and to evaluate the learning outcomes achieved by the students.
The current list of learning outcomes used by the teachers at the WKMOMU and presented to PUMS experts is too general, thus the medical education process cannot be evaluated successfully.
2. The modern and perspective model of medical education involves the continuous education. Therefore, the proper curriculum for the laboratory diagnostic should enable to acquire the relevant knowledge, skills and competencies, progressing from the basic sciences to clinical practice. The curriculum also should allow to modify and develop its subject matter in face of the healthcare challenges (e.g., the role of laboratory diagnostics in the COVID-19 pandemic).
3. The subject content must be revised, and the meaning of laboratory diagnostics as a medical specialty with some sub-specializations, to a lesser extent, should contribute to it.
4. The details of the syllabi concerning laboratory diagnostics and the relevant courses, according to the subject content, the quantity and quality (type) of teaching hours, and educational methods raised doubts. The proportion of various forms of teaching is ineffective for the courses completion.
5. The categories of teaching hours: "individual students' work" and "individual student's work under the teacher's control" are incomprehensible. The essential items, mostly practical, cannot be implemented in this manner. Some of the difficult and important topics are included in individual student's work. Moreover, this category of teaching hours does not appear in the worldwide standards (Bologna process).
6. Theoretical knowledge is provided as practical classes. It was stated for laboratory diagnostics and preceding courses, i.e., biochemistry, molecular biology, immunology, microbiology. Especially during the biochemistry course, students could practice some elements supporting the subsequent matters.
7. There is no laboratory diagnostics specialists and separate department of laboratory diagnostics at WKMOMU, presented as a clinical unit. The laboratory diagnostics classes are delivered by general practitioners, specialists, and sub-specialists of internal medicine, and pediatricians, depending on the level of medical education currently present in the Republic of Kazakhstan.
Some changes leading to the establishment of the Department of Laboratory Diagnostics have been initiated and they should be carefully monitored not to neglect the idea of the course, as

the newly introduced unit was called the Department of Clinical Laboratory and Visual Diagnostics which had not been recommended by PUMS experts.

8. The WKMOMU documents did not show the list of necessary equipment/devices/analyzers owned by the departments allowing for conducting practical classes according to the items presented in the syllabus. After a visit to the departments and meeting the teachers and students, it was stated that the theoretical knowledge is provided as practical classes in terms of laboratory diagnostics and other relevant courses, including biochemistry, molecular biology, immunology, microbiology etc. The real practical classes have been very limited due to the lack of laboratory equipment and reagents. Laboratory medicine originated, developed, and differentiated itself originally from biochemistry and histology to provide answers for the clinical questions. On the other hand, clinical disciplines search for the solutions and indicate directions for research. Therefore, the strong basic sciences (morphological sciences and scientific principles of medicine), presented by a professional staff, in well-equipped departments are fundamental for further medical education, as well as for the development of the pre-clinical sciences, and non-surgical and surgical clinical sciences.

9. The Task Leader visited the clinical laboratory at the university hospital twice, observing its development and progress. Some educational activities in this laboratory were available only as part of a general medicine internship.

A certain gap between teaching and practicing has been observed. The educational process has failed to keep pace with the clinical laboratory practice, including immunology and histopathology (immunohistochemistry techniques and flow-cytometry).

Modern practice of laboratory diagnostics should be presented in the course of the obligatory undergraduate medical education.

The similar situation has been observed for pathomorphology/histopathology. Modern pathology practice, including a rapidly developing immunohistochemistry and molecular biology, should be presented in the course of the obligatory undergraduate medical education in this discipline.

Only under these improvements laboratory medicine can develop at the WKMOMU.

10. Poor knowledge of the English is still observed among the academic teachers, which makes it challenging to follow the contemporary medical literature and to practice new diagnostic techniques, hence slowing the individual professional development, including the field of laboratory medicine.

III.1. DESCRIPTION OF THE PROPOSED NEW LABORATORY DIAGNOSTICS PROGRAM FOR THE WKMOMU UNDERGRADUATE STUDENTS

1. The development of the undergraduate educational program for the discipline "Oncology: oncological laboratory diagnostics" at the WKMOMU is possible. It must be preceded by a development of the undergraduate academic program for laboratory medicine in general.
2. Laboratory diagnostics, as an interdisciplinary course, should be obligatory for the undergraduate medical program. The successful differential diagnosis is a challenge in modern medicine. Therefore, laboratory medicine, including regular laboratory diagnostics (on blood, urine, and other body fluids) or histopathology examinations, must develop various laboratory techniques.
3. National qualification framework and the list of detailed learning outcomes in the field of knowledge, skills, and competencies – should be used while preparing a curriculum, including laboratory diagnostics and oncological laboratory diagnostics. The Profile of a Graduate of the Faculty of Medicine should define the scope of the curriculum.
A well-prepared abovementioned changes should allow for possible further modifications in the curriculum resulting from the emerging changes in the Health Needs maps, both on the national and international level.
4. The list of the detailed learning outcomes was prepared and presented under Task 1A1, in which the Leader of Task 2B was simultaneously the Key-expert.
Therefore, the WKMOMU experts and specialists may apply the learning outcomes derived from the Project or, on the basis of the Project results, develop their own comprehensive learning outcomes. The list of the detailed learning outcomes approved by the relevant Ministry of Republic of Kazakhstan should be available for the medical universities of the country allow for the inter-university mobility and uniform medical education in the Republic of Kazakhstan.
5. In the course of the medical education, laboratory diagnostics must be considered a medical specialty in the category of the non-surgical clinical sciences, with its characteristic issues and attributes.
6. The issues of the course in the syllabus (or syllabuses) should refer to the detailed learning outcomes included. The coordinator of the Laboratory Diagnostics course should be able to monitor the achievements of the students' learning outcomes.
7. Although the basic science knowledge is fundamental, it is a common worldwide trend to introduce clinical topics as soon as possible, planned gradually and proportionally. The interdisciplinary nature of laboratory diagnostics provides its unique clinical significance. Therefore, the development of the undergraduate program starting with basic science and progressing to the clinical practice is expected.

8. The future Department of Laboratory Diagnostics (Laboratory Medicine) should be established within a clinical, medical diagnostic laboratory. Optionally, teachers and students of the laboratory diagnostics should have an unrestricted access to the clinical laboratory practice.
Similarly, the current Department of Anatomical Pathology (pathomorphology, histopathology) should be equipped with modern microscopes and analyzers in order to present new solutions in the relevant disciplines to the students.
All improvement activities undertaken by the WKMOMU should take into account the clinical-laboratory and interdisciplinary nature of the course. Moreover, a well-started activity of the Departments can constitute the basis for the development of sub-specialties, including hematological, immunological and genetic diagnostics, as well as others, and to collaborate successfully with already existing departments.
9. Prior to education a sufficient number of laboratory diagnostics (laboratory medicine) specialists, physicians who are biochemists, pathophysiologists and clinicians (e.g., internal medicine specialist and pediatricians) can be involved in the educational process.

The aims of the undergraduate education in the scope of laboratory diagnostics:

- to obtain qualifications: knowledge, skills and competencies, in accordance with current medical knowledge, which allow for the selection of laboratory tests and the interpretation of the obtained results with particular emphasis on the interfering factors;
- to acquire knowledge and skills regarding the collection of basic biological samples and the performing some of them, including point-of-care testing;
- to acquire skills and competencies in the area of cooperation with various medical professionals;
- to participate in the shaping the desired personality traits of doctors, shaping ethical attitudes,
- to develop the obligation of continuous self-education, expanding and improving knowledge and practical skills, and introducing new achievements into the professional practice.

The rules for improving the educational model and program of laboratory diagnostics at the WKMOMU – explained by Comments to the Road map:

a) general requirements for developing a curriculum
b) requirements for academic staff professionalism
c) requirements for the educational resources
d) the role of the Coordinator of the Laboratory Diagnostics course.

III.2. PROPOSALS FOR A REVISED PROGRAM FOR THE UNDERGRADUATE MEDICAL STUDENTS IN LABORATORY DIAGNOSTICS, INCLUDING ONCOLOGICAL LABORATORY DIAGNOSTICS.

1. Basic challenge – to implement a revised program for laboratory medicine obligatory for the undergraduate medical education.
2. A strong, updated program for laboratory medicine can develop due to health care needs prepared by the Government of Republic of Kazakhstan.
3. The curriculum of laboratory medicine is fundamental for the oncological laboratory diagnostics. It will affect other disciplines, basic sciences, preclinical and clinical sciences. The implemented modern analytical tools of immunochemistry should help in the improvement of the pathomorphology/histopathology curriculum. In fact, the academic courses, laboratory diagnostics and pathomorphology/histopathology, should demonstrate high quality clinical practice.

Objective of laboratory diagnostics

The objective of the Laboratory Diagnostics course is to provide students with:

the opportunity to gain knowledge regarding:

- laboratory tests and the criteria for considering them as independent medical information,
- principles of applied laboratory methods to the extent necessary for the correct ordering of laboratory tests and interpretation of the obtained results,
- principles of clinical and laboratory cooperation within the medical diagnostic laboratory;
- advantages, limitations and challenges of modern laboratory diagnostics with regard to screening, diagnosis and monitoring of the diseases;

the opportunity to acquire the skills to:

- select appropriate laboratory tests in various clinical situations,
- correctly interpret their results,
- collect biological material, including venous blood and capillary blood, and to perform basic point-of-care tests (POCT)

competences:

- make rational use of laboratory tests in the area of prevention, diagnosis and monitoring of pathological states.

Entry requirements

Anatomy, histology, chemistry, biochemistry, physiology, pathophysiology, immunology (preferable), fundamentals of internal diseases (preferable), fundamentals of pediatrics (preferable)

The scope of the required theoretical knowledge and the list of practical skills to successfully complete the Laboratory Diagnostics course:

Laboratory diagnostics is strongly based on the basic science and preclinical courses, and student have to achieve the relevant learning outcomes first.

Laboratory diagnostics is an interdisciplinary clinical course using various laboratory techniques to assess the regularity of vital processes and the degree of pathology.

Laboratory diagnostics is the essential part of the clinical practice for diagnosis, prognosis, and monitoring of the diseases.

Teaching hours

Laboratory diagnostics classes could be conducted for 100 hours in the following pattern: 20 hours of lectures, 20 hours of seminars and 60 hours of practical classes.

Recommendations

Lectures should comprise the selected basic topics, which constitute a continuation and extension of the biochemical and pathophysiological issues necessary to gain the requisite knowledge.

Seminars should include the topics requiring some teacher-students interaction to present difficult or problematic issues and solutions.

Practicals should be intended as practical classes in a medical diagnostics laboratory. Some classes could be performed in the basic science/pre-clinical departments while addressing issues relevant for laboratory diagnostics in order to prepare students for the clinical laboratory practice.

Assessment of the achieved the learning outcomes

It should be performed using the matrix of the learning outcomes.

The methods should vary depending on the chosen model of educational process in laboratory diagnostics. The evaluation could be divided into parts if the issues are differentiated and classes are conducted in the subsequent years of study.

Practical skills required to pass the course should be determined.

The course should end with a final exam. Appropriately structured test questions will allow to evaluate the knowledge and some skills.

The Coordinator of the Laboratory Diagnostics course is responsible for checking whether all relevant learning outcomes have been achieved in the course of the undergraduate education.

The issues of laboratory diagnostics could be implemented in morphological sciences, scientific principles of medicine, preclinical, and clinical sciences (non-surgical and surgical), taking into account grading the students' knowledge, skills and competencies. However, laboratory diagnostics is an academic course in the category of clinical sciences, with its specific features. The distribution of the topics must be perfectly monitored (using detailed learning outcomes),

e.g., carbohydrate metabolism in biochemistry, followed by laboratory testing and its clinical significance.

Due to the worldwide tendency to specialize in the medical professions, sub-specialties in the field of laboratory medicine have been established, therefore, the medical university must be prepared to develop separate courses, including clinical microbiology, medical genetics, clinical immunology, immunohematology etc., to keep the dominant role of medical professionals in the educational process.

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The Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, edited by Nader Rifai, 6th Edition 2017 by Elsevier Saunders.

It provides the current guidelines on selecting, performing, and evaluating the results of laboratory tests. The textbook offers analytical criteria for the medical implementation of laboratory procedures, explains reference ranges, describes variables which affect tests and results, and presents modern analytical tools.

Clinical Laboratory Diagnostics, edited by Lothar Thomas, 8th Edition 2012 by TH-Books-Verl.-Ges. mbH;

Clinical Laboratory Diagnostics, edited by Lothar Thomas, 10th electronic English edition 2020, https://www.clinical-laboratory-diagnostics-2020.com/.

It has been intended to serve as a useful reference and a resource for the comprehensive interpretation of laboratory test results, essential for a differential diagnosis and monitoring the course of a disease. It presents the attributes of laboratory diagnostics comprehensively.

Fundamentals of Urine & Body Fluid Analysis. Nancy A. Brunzel, 4th Edition 2016, Elsevier Saunders.

It is necessary to learn to accurately analyze urine and body fluids. It contains full-color illustrations and covers the fundamental principles of urine and body fluids testing in the clinical laboratory. The book includes the methods of collection and analysis of urine, fecal specimens, vaginal secretions, and other body fluids such as cerebrospinal, synovial, seminal, amniotic, pleural, pericardial, and peritoneal fluids. It demonstrates how to correlate data with the knowledge of basic anatomy and physiology in order to understand the pathologic processes.

SUBJECT CONTENT

I. The principles of laboratory diagnostics

General issues

Laboratory diagnostics as a branch of science addressing the parametric way of describing health and disease.

Clinical laboratory results. Factors influencing the laboratory test results, including analytical and non-analytical errors (laboratory and non-laboratory).

Pre-analytical phase. The rules for collection, sampling and storage of the biological material, taking into account the preparation of the patient, selection of appropriate anticoagulants and preservatives.

Principles of assessing the reliability of the results and their diagnostic utility.

Principles of determining the ranges of reference values. The idea of decision-making values and permissible error limits.

The concept of diagnostic sensitivity and specificity, and predictive value. Diagnostic efficiency.

Principles of organization and management of the laboratory, including work organization, transfer of information, registration and archiving of results, calculation of research costs and principles of work safety for the patients and staff.

Principles of organization and supervision of point-of-care testing (POCT).

The principles of the quality system in the medical diagnostic laboratory. The medical standards of International Organization for Standardization (ISO) and the concept of accreditation.

Principles of clinical laboratory techniques:

Instrumental techniques in a medical diagnostic laboratory.

Optical techniques.

Electrochemistry and chemical sensors.

Electrophoresis.

Chromatography.

Mass spectrometry.

Immunochemical techniques.

Molecular biology methods.

Flow cytometry.

Microscopic techniques.

Automation and types of analyzers, and their technical capabilities.

Point-of-care testing.

II. Basic laboratory diagnosis of the systemic and organ disorders

II.1. Clinical Chemistry

Carbohydrate metabolism.

The principles of laboratory methods of carbohydrate disorders assessment, functional tests.

The role of laboratory tests in the diagnosis of diabetes and monitoring its treatment.

Lipid metabolism

The principles of laboratory methods for the assessment of lipid metabolism disorders.

Qualitative and quantitative determinations of lipids and lipoprotein components.

Primary and secondary dyslipoproteinemia.

Lipid factors in the development of atherosclerosis.

Nitrogen metabolism

Measurement principles of nitrogen metabolism parameters in biological material, including ammonia, urea, creatinine, uric acid and amino acid.

Disorders of nitrogen metabolism in different pathologies.

The diagnostic significance of increased and decreased blood level of the nitrogen metabolism parameters.

The notion of prerenal, renal and extrarenal pathology, as well as gout and other clinical conditions.

Bilirubin metabolism

The principles of bilirubin fraction determination in body fluids.

Classification of hyperbilirubinemias.

Laboratory differentiation of jaundice in the clinical practice.

Water and electrolyte balance, acid-base balance and blood gases

The role of laboratory diagnostics in the assessment of water balance and body fluid compartments.

Plasma electrolytes and electrolyte disturbances with view of the causes. Osmolality, osmotic gap, osmotic clearance and free water clearance.

The classification and diagnosis of water and electrolyte disturbances, types of dehydration and overhydration.

Laboratory parameters for the diagnosis of acid-base imbalances and blood gases disturbances.

Anion gap and its diagnostic significance.

Laboratory assessment of oxygen availability in tissues.

Simple and mixed acid-base balance disturbances: classification, causes, mechanism and assessment of compensation degree.

Iron metabolism

Laboratory parameters of iron metabolism.

Disorders of iron metabolism in different pathologies.
The diagnostic significance of increased and decreased blood level of the iron metabolism parameters.
Porphyria
Parameters of porphyrin and heme metabolism in body fluids.
Clinical laboratory diagnosis of porphyrias.
Bone and mineral metabolism
Biochemical markers of bone metabolism, including the bone structure and hormonal and vitamin factors affecting.
The principles of laboratory determination of calcium and phosphate metabolism.
Laboratory diagnosis of metabolic bone disorders.
Trace elements.
The role of selected trace elements in human pathology and the diagnostic significance of their blood level.
Enzymes
The rules of enzymatic determinations, activity and concentration of enzymes, the role of coenzymes.
The principles of isoenzyme and isoform measuring and its diagnostic significance.
Laboratory diagnosis of enzymatic defects.
Diagnostic importance of enzyme determination in various organ pathologies.
Proteins
The principles of protein determination (chemical and immunochemical methods) and separation (e.g., electrophoretic techniques, blotting, immunochemical techniques).
Laboratory diagnosis of hyper-, hypo- and dysproteinemias.
The principles of laboratory determination of specific proteins, including acute phase proteins, transport, storage and receptor proteins, and tissue-specific proteins, and the diagnostic significance of their blood level.
Immunoglobulins. Mono-, oligo-, and polyclonal gammopathy. Identification of monoclonal proteins, interpretation of qualitative and quantitative results.
Autoantibodies – the principles of measuring and interpreting the results.
Hormones and vitamins
The principles of hormone determination in blood and urine. Functional tests in endocrinology.
Laboratory diagnosis of various endocrine system disorders.
Hormonally active tumors, ectopic hormone secretion.
The diagnostic role of tissue hormones (gastrointestinal hormones, renin-angiotensin-aldosterone system, erythropoietin, prostaglandins).
The principles of vitamin determination in blood. The diagnostic significance of various vitamin level in blood.

Tumor markers

Definition and classification of tumor markers.

Tissue/organ specificity of tumor markers.

The principles of tumor marker determination and their importance for the diagnosis, prognosis and monitoring of the neoplastic disease treatment.

II.2. Clinical laboratory - hematology and hemostasis

Laboratory diagnosis of the hematopoietic system. Hematology.

General overview

Blood and bone marrow morphological parameters, interpretation of results with regard to the age and sex of the examined person.

Automation in hematology – the principles of the measurement techniques used in the clinical laboratory.

The determination, calculation and interpretation of basic hematological indices, including the interpretation of results obtained with the use of analyzers.

The laboratory investigation of blood and bone marrow smears and the interpretation of the results.

The role of biochemical, cytochemical, genetic and immunological tests (including flow cytometry) in hematological diagnostics.

Red blood cell system

The role of laboratory tests in the classification and differentiation of anemias: microcytic, normocytic, macrocytic and regenerative, and non-regenerative anemias.

Laboratory diagnosis of various types of anemia, including iron deficiency anemia, vitamin B12 and folate deficiency anemia, aplastic anemia, hemolytic anemia, sideroblastic anemia, red blood cell enzymopathies and hemoglobinopathies.

Laboratory diagnosis of anemia of chronic disease (ACD).

Erythrocytosis and its clinical significance.

White blood cell system

The laboratory determination of white blood cell count and leukocyte distribution.

The principles of laboratory techniques for leukocyte investigation, including microscopy, phenotyping, and functional tests.

The diagnostic significance of increased and decreased number of different leukocytes.

Modern diagnosis of acute leukemias and lymphomas.

The principles of the laboratory diagnosis of chronic myeloproliferative diseases.

Laboratory diagnostics for myelodysplastic syndromes.

Disease syndromes with gammopathy.

The platelet formation system

The principles of laboratory determination of platelet count, morphology and function.

Laboratory diagnosis of thrombocytopenia and thrombocytosis.
Hematological complications in the course of non-hematological diseases

Laboratory diagnosis of hemostasis disorders
The principles of laboratory examination of hemostasis.
The laboratory diagnosis of platelet function and its disorders.
Laboratory diagnosis of hemorrhagic disorders with reference to vascular, and plasma coagulation and fibrinolysis system disorders.
Plasma coagulation system and fibrinolysis – basic and advanced laboratory testing, and its clinical significance.
Laboratory diagnosis of disseminated intravascular coagulation and hyperfibrinolysis.
Laboratory diagnosis of thrombophilia.
The role of laboratory tests in thrombosis and embolism.
Laboratory monitoring of anticoagulant and fibrinolytic therapy.

II.3. Examination of body fluid, excreta and secretions
Urine test
Basic urinalysis – physical and chemical parameters, the techniques of testing and interpretation of the results.
The methods of urine sediment assessment.
Periodic urine collection (including daily urine collection) as research material.
The role of urine testing in the urinary system disorders.
Proteinuria and its differentiation.
Examination of the cerebrospinal fluid
Basic investigations of the cerebrospinal fluid.
Special investigations.
Diagnostic significance of protein determinations and differentiation in the cerebrospinal fluid.
The role of cerebrospinal fluid tests in the diagnosis of primary and secondary nervous system diseases - infections, neurodegenerative diseases, hemorrhages, and malignancies.
Examination of body cavity fluids
Basic investigations and a differentiation of exudates and transudates.
Management of fluids depending on the source and the collection site.
Examination of synovial fluid
Basic investigations.
Special investigations, including clinical chemistry tests, cell count and differential cell count, microscopic examinations, immunochemical tests
Clinical significance of the synovial fluid results in joint disorders, including non-inflammatory, inflammatory, septic, and traumatic effusions.

Examination of the contents of the stomach and duodenum

Basic and special investigations.

General and functional examination of the sperm

Basic and special investigations.

Stool examination

General examination of stool, occult blood and biochemical tests.

II.4. Laboratory diagnosis of microbe markers

Laboratory diagnosis of bacterial, viral and fungi infections

Clinical significance of measuring the markers of bacterial, viral and fungi infections in blood and other biological materials.

Molecular diagnostics and polymerase chain reaction (PCR) in infectious diseases. Diagnostic significance of the results.

Laboratory diagnosis of parasitic diseases

The types of material for parasitological examination and the testing techniques.

The laboratory measurement of parasitic infestation markers in blood and other body fluids.

Diagnostic significance of immunological testing in the diagnosis of parasitic diseases and its interpretation.

II.5. Immunohematology and transfusion medicine

Blood groups and pre-transfusion testing.

Transfusion reactions.

III. Laboratory diagnosis of systemic and organ disorders

Laboratory diagnosis of inflammation

Local and systemic inflammatory response.

Mediators of inflammation. Inflammatory cells.

Sepsis and systemic inflammatory response syndrome (SIRS)

Tests for the diagnosis of inflammation, including infectious diseases.

Laboratory diagnosis of the immune system

Non-specific immunity.

Specific cellular and humoral immunity.

Primary and secondary immunodeficiencies and their diagnosis.

Laboratory diagnosis of cardiovascular diseases

Acute coronary syndrome, primary and secondary arterial hypertension, heart failure.

The role of laboratory tests in the cardiovascular risk assessment.

Laboratory diagnosis of digestive system diseases

The role of laboratory tests in the diseases of the stomach, duodenum, and intestines.

Laboratory assessment of the acute and chronic diseases of the pancreas.

Laboratory diagnosis of liver diseases

Laboratory testing of liver function – the role of multi-parameter profile.

Laboratory diagnosis of acute and chronic liver diseases.

Laboratory diagnosis of kidney and the urinary tract diseases

Laboratory assessment of kidney function.

Acute kidney damage and chronic kidney disease – the effects on blood and urine testing.

Laboratory diagnostics of urinary tract disorders, including infection and urolithiasis.

Laboratory diagnosis of respiratory diseases

The role of laboratory tests in respiratory failure, respiratory infections, and pulmonary embolism.

Laboratory diagnosis of endocrine system diseases

The role of laboratory tests in the pathologies of particular endocrine glands.

Laboratory diagnosis of the immune system disorders:

- immunodeficiencies,
- autoimmune diseases,
- allergic diseases;

Laboratory diagnosis of the nervous and muscular systems diseases:

- inflammatory diseases of the nervous and muscular systems,
- cerebrovascular diseases,
- degenerative diseases,
- neuropathies and myopathies;

Laboratory diagnosis of the neoplastic diseases:

- tumor markers,
- basic laboratory tests,
- genetic tests,
- paraneoplastic syndromes,
- laboratory testing in advanced malignancy.

Laboratory diagnosis of hematopoietic diseases:

- differential diagnosis in various types of anemia;
- erythrocytosis, primary and secondary;
- myeloproliferative diseases
- proliferative diseases of the white blood cell system;
- acute leukemias and lymphomas;
- myelodysplastic syndromes;
- disease syndromes with gammopathy.

Laboratory diagnosis of hemostasis disorders

Hemorrhagic disorders.

The role of laboratory tests in the diagnosis of congenital and acquired coagulopathies, as well as in complex bleeding disorders. Laboratory diagnosis of hemophilia and von Willebrand disease.

The role of laboratory tests in the management of thrombotic disorders and their complications.

Disseminated intravascular coagulation and hyperfibrinolysis.

Laboratory monitoring of treatment with anticoagulants.

Laboratory diagnosis of systemic rheumatic diseases

Principles of laboratory diagnosis in toxicology and therapeutic drug monitoring

Laboratory diagnosis of the most common acute and chronic poisoning, including drugs, alcohols, carbon monoxide, fungi, and heavy metals.

The principles and challenges of measuring narcotic substances in the body fluids.

The principles of determination of therapeutic and toxic drug concentrations and interpretation of the results.

IV. Laboratory diagnosis in particular clinical situations

Laboratory diagnosis in the neoplastic disease

Laboratory tests in life-threatening conditions

Laboratory tests in monitoring the course of pregnancy

Differences in laboratory diagnostics in pediatrics

Differences in laboratory diagnostics in the elderly

Laboratory aspects of nutrition

Laboratory diagnosis in transplantology

Laboratory diagnosis of rare diseases

Attachment 2B1 – II

The road map of the insertion of the new program in laboratory diagnostics into the educational process

Stage	Dura-tion	WKMOMU		Central (Republic of Kazakhstan) regulation
1		1. National qualification framework and the list of the detailed learning outcomes regarding the knowledge, skills, and competencies – should be used while preparing a curriculum. 2. The Profile of a Graduate of the Faculty of Medicine should be presented.	←	The official document including the list of detailed learning outcomes regarding the knowledge, skills, and competencies for the medical doctors should be available at the medical university.
2		A Curriculum Board of the Faculty of Medicine should be appointed amongst the WKMOMU specialists and experts, representing basic sciences, preclinical courses, and clinical courses.		
2		The Curriculum Board approves the principles of the courses (subjects), including topics, teaching hours, and types of classes.	← →	The government guidelines, or the approval in the university regulations.
2		The Members of the Board discuss and create the requirements for the course (subject).		
2		The Board appoints a coordinator of the course.		
3	One month	The Coordinator of Laboratory Diagnostics must be appointed, considering the teaching experience, medical specialty, and professionalism.		
3	Two months	The Coordinator is responsible for preparing the final version of the syllabus for the course and its implementation.		
3	One months	The Coordinator proposes departments participating in conducting classes in Laboratory Diagnostics.		
3	Two months	The Coordinator assesses the compliance of the departments with the training requirements for Laboratory Diagnostics.		

3	One month	The cooperation rules for the departments involved in implementing the Laboratory Diagnostics curriculum must be established.		
4		The Heads of the Departments are accountable to the Coordinator for the educational activities they conduct.		
4		The Coordinator is responsible for correcting the ongoing educational process from the formal to the substantive side.		
4		The evaluation of the achieved learning outcomes by the students must be conducted.		
		Perspectives		
5		Following developing Laboratory Diagnostics as a teaching course and clinical specialty at the WKMOMU, the experts will improve laboratory medicine for various specific medical disciplines, e.g., oncological laboratory diagnostics.		
5		A well- prepared course of Laboratory Diagnostics at the WKMOMU, starting from the basics, will help medical professionals to manage both current and future health care challenges.	←	Mapping Health Needs (National Maps of Health Needs preparing by the Ministry of Health) in the Republic of Kazakhstan could update the medical education and support the health system management.

SUMMARY OF COMMENTS ON THE INSERTION OF THE NEW PROGRAM OF LABORATORY DIAGNOSTICS AT WKMOMU

Laboratory diagnostics as a discipline

According to the WHO, "In vitro diagnostic tests are used for in vitro examination of specimens derived from the human body to provide information for screening, diagnosis, or treatment purposes."

Thus, as a discipline, laboratory diagnostics is a branch of medical diagnostics which deals with laboratory methods for screening, diagnosis, or treatment monitoring.

The role of laboratory diagnostics in the modern healthcare system is to provide medical doctors with reliable, high-quality information relevant for the screening, diagnosis, or treatment monitoring.

The worldwide challenge is the laboratory staff: Who is qualified to practice laboratory diagnostics? How should the medical laboratory staff be educated and trained?

Medical laboratory staff comprised of specialists in laboratory diagnostics is preferred. Graduates of biology, chemistry, etc. faculties who have not been educated in pathophysiology and clinical biochemistry are not qualified to be the only staff for medical laboratories. Pathophysiology and pathobiochemistry, as well as knowledge and practice in the use of modern technology in laboratory testing, constitute the fundamental areas of education and training of the laboratory staff.

The basis for the laboratory diagnostics are methods comprising pre-analytical, analytical, and post-analytical processing of biological samples in the medical laboratory to obtain reliable medical information.

Laboratory diagnostics comprises several topics: hematology and coagulation, clinical biochemistry, immunology, immunohematology and blood bank, cytology, microbiology, and molecular tests. Laboratory diagnostics includes pre-analytical, analytical, and post-analytical processing of biological samples, as well as the application of modern technologies for laboratory testing. Attributes of different laboratory methods are essential to apply the technique to clinical laboratory practice.

1. The background:

The learning outcomes for the medical doctors have been established and confirmed by the relevant ministry of the Republic of Kazakhstan, which includes the list of the detailed learning outcomes regarding the knowledge, skills, and competencies.

The government guidelines may specify the number of hours devoted to achieving specific learning outcomes and conducting given courses.

Each medical university should implement learning outcomes in preparing the current educational curriculum (learning outcome-based study program), especially in possible students' inter-university mobility.

A Curriculum Board at the Faculty of Medicine should be appointed amongst the selected specialists and experts, representing basic sciences, preclinical courses, and clinical courses. The Members of the Board are responsible for assigning learning outcomes to the relevant issues and to a given WKMOMU chair/department/unit to perform them.

The Board approves the principles for the course, including topics, teaching hours, and types of classes.

The Board provides requirements and establishes a coordinator of the course.

The Coordinator is responsible for preparing the syllabus of the courses.

The Coordinator of the Course/specialty/subspecialty is responsible for its implementation, ongoing educational process, and the evaluation of the achieved learning outcomes by students.

The issues included in the courses should be established, and a discussion should take place on how students can master them in terms of knowledge, skills and competences– which departments are suitable to teach them, taking into consideration:

a) professionalism of the academic staff
b) educational resources, including the necessary equipment for the required training.

2. Adoption of Polish/European/worldwide learning outcomes appropriate for Laboratory Diagnostics could be performed before the Republic of Kazakhstan's central regulation is available.
PUMS experts prepared the list of the detailed learning outcomes for the undergraduate medical program and presented in Task 1A1.

3. Establishing the Coordinator of Laboratory Diagnostics at the WKMOMU:
- The head of the department of laboratory diagnostics, considered as a clinical unit – a physician [MD, Ph.D.], a specialist of laboratory diagnostics is preferred,
or prior to the achievement of the abovementioned criteria by the WKMOMU, professor or [MD, Ph.D.]:
- The specialist of internal medicine – physician [MD, Ph.D.] who is interested in the modern laboratory diagnostics with its multiple specialty areas and determined to specialize in laboratory diagnostics.
- Physician [MD, Ph.D.] experienced in clinical/medical biochemistry, determined to specialize in laboratory diagnostics.
Laboratory diagnostics (laboratory medicine or clinical pathology in some countries) is the medical specialty dealing with diagnosing diseases on the basis of the laboratory analysis of various body fluids, including blood and its components (plasma and cells), urine, stool, secretions, body cavity fluids, and the cerebrospinal fluid. The specialists are responsible for supervising the measurement process and performing quality assurance. The specialists provide interpretations of different tests (i.e., microscopic analysis, flow cytometry), are consultants for the clinicians, and provide help in choosing the appropriate testing method for an individual patient's condition. Sub-specializations of laboratory medicine are certified in the following manner, although the terms can differ in some countries: laboratory diagnostics (clinical chemistry, clinical pathology), laboratory hematology, transfusion medicine (blood transfusion), medical microbiology, molecular genetic pathology (medical genetics).

The Coordinator of Laboratory diagnostics will be responsible for the educational process of medical students. Laboratory diagnostics:
- follows basic sciences,
- cooperates with other laboratory medicine disciplines/specialties (e.g., modern histopathology employs immunochemistry techniques),
- is a source of medical data/results,
- is the most interdisciplinary clinical subject, and its activities are widely used in others.

4. Understanding laboratory medicine and laboratory diagnostics in the clinical practice.

Departments/units/sections which provide laboratory medicine in the modern healthcare system:

Model A. Department of Pathology is divided into two main units:

I. Anatomical pathology/path morphology/pathology, including histopathology, cytopathology (using various laboratory techniques);

II. Clinical pathology (laboratory diagnostics), including clinical chemistry, hematology, coagulation, immunohematology and blood bank, clinical microbiology, molecular diagnostics (with subspecialty: cytogenetics) as a separate unit, or a part of, e.g., hematology or clinical microbiology, reproductive biology (in laboratories collaborating with departments of gynecology and obstetrics)

Model B. Two independent, separate departments are established:

I. Anatomical pathology/pathomorphology/pathology, including histopathology, cytopathology (using various laboratory techniques);

II. Clinical pathology (laboratory diagnostics), including clinical chemistry (clinical biochemistry, urinalysis and other body fluid testing), hematology, coagulation, immunohematology and blood bank, clinical microbiology, parasitology, molecular diagnostics (with subspecialty: cytogenetics) as a separate unit, or a part of, e.g., hematology or clinical microbiology, reproductive biology (in laboratories collaborating with departments of gynecology and obstetrics)

Model C. Several independent, separate departments are established - mostly:

I. Anatomical pathology/pathomorphology/pathology, including histopathology, cytopathology (using various laboratory techniques);

II. Clinical pathology (laboratory diagnostics), including clinical chemistry (clinical biochemistry, urinalysis and other body fluid testing), hematology, coagulation, blood bank,

- molecular diagnostics, including cytogenetics – separately, or as a part of, e.g., hematology, clinical microbiology, and reproductive biology (in laboratories collaborating with specific clinical departments).

III. Clinical microbiology – based on the traditional and advanced (molecular biology) laboratory techniques.

Other disciplines of clinical pathology (laboratory diagnostics) might function separately, due to the local tradition, special and extended clinical needs, and legal regulations.

4.1. PUMS experts recommend considering Laboratory diagnostics as a part of the model mentioned above: "C. Several separate independent departments", since the European and American solutions have evolved over the years from Model A through Model B to Model C. Contemporary medicine is getting deeper and deeper into details, including laboratory

diagnostics. Thus, it seems more reasonable to make an effort to organize laboratory medicine at the WKMOMU according to new worldwide solutions and trends.

We recommend to improve the Laboratory Diagnostics course, to cover clinical biochemistry, urinalysis, and other body fluid testing, hematology, coagulation, and basis of immunohematology and blood bank. The Department of Laboratory Diagnostics /Laboratory Medicine, based on a clinical laboratory (in hospital), should be established.

We recommend to improve the course: Anatomical pathology, to increasingly progress toward the molecular level of tissue examination, using special staining techniques and immunohistochemistry. The existing department at the WKMOMU should be extended and based on the clinical practice.

The medical university and the academic teachers should be the leaders of progress in medicine, including laboratory medicine. The existing and future Departments will be suitable for teaching students and specializing medical doctors after improving:

a) professionalism of the academic staff, including several relevant specialists

b) educational resources, including the necessary equipment for the required practice.

The basic and regular laboratory diagnostics (Clinical pathology), and pathomorphology/ histopathology (Anatomical pathology) must be properly created primarily for its clinical practice and educational activities at the WKMOMU.

Subsequently, a specialized branch of oncological laboratory diagnostics may be developed.

4.2. The fundamental aspects of laboratory medicine/laboratory diagnostics must be addressed:

- Principles of laboratory medicine/laboratory diagnostics.
- Characteristics of laboratory methods
- Biological specimen processing and affecting factors
- Laboratory diagnostics as a clinical science
- Laboratory information system
- Quality assurance system in Clinical Laboratory. (Medical laboratory accreditation)

5. Laboratory Diagnostics – educational process and program at the medical university

5.A. Searching for the existing courses in the area of basic, preclinical, and clinical sciences which allow for the achievement of learning outcomes in the field of laboratory diagnostics:

The student must be properly prepared to train and practice the modern laboratory diagnostics so that patients could benefit from the doctor's knowledge, skills, and competences. It is similar to the educational process for internal disease, pediatrics, surgery, etc. The particular feature of laboratory diagnostics is its interdisciplinary character and potential applicability in various medical disciplines.

The idea is to progress from basic sciences to clinical practice.

The educational process in laboratory diagnostics should connect theory to practice through the application of knowledge to the cases, using inquiry-based learning methods. Case-based learning (CBL) aims to prepare students for clinical practice by means of authentic laboratory test results of clinical cases. Selected cases should represent typical cases versus diagnostically challenging issues, interdisciplinary problems, errors in diagnostics, as well as rare, but life-threatening cases.

5.B. Laboratory Diagnostics is a separate academic course, and following the graduation – a medical specialty.

Laboratory diagnostics (laboratory medicine or clinical pathology in some countries) is the medical specialty dealing with diagnosing diseases based on the laboratory analysis of various body fluids, including blood and its components (plasma and cells), urine, stool, secretions, body cavity fluids, and cerebrospinal fluid.

The specialists are responsible for supervising the measurement process and performing quality assurance. The specialists provide interpretations of different tests (e.g. microscopic analysis, flow cytometry), are consultants for the clinicians, and provide help in choosing the appropriate testing method for an individual patient's condition.

Sub-specializations of laboratory medicine are certified in the following manner, although the terms can differ in some countries: laboratory diagnostics (clinical chemistry, clinical pathology), laboratory hematology, transfusion medicine (blood transfusion), medical microbiology, molecular genetic pathology (medical genetics).

5.C. Postgraduate education

At the level of the postgraduate education, laboratory staff develops the knowledge, skills, competence, and behaviors consistent with the specialist activity in 3 areas:

- clinical - the specialist assesses the laboratory tests appropriate for the diagnosed population, considers biological variability, genetic influences, environmental influences, age, sex, nutrition, season and time of the day, the impact of therapeutic agents; evaluates the implementation of these investigations to the clinical diagnosis and treatment, provides the expertise to ensure appropriate test application and authorization;
- professional - the specialist can take personal responsibility for his/her actions, to work independently, to take the initiative in recognizing complex and unpredictable problems and to solve them through the process of authorization, which results in reliable reports for the clinicians; prepares diagnostic strategies and analytical goals in the use of laboratory;
- scientific – the specialist uses and understands laboratory statistics, assesses, plans, conducts, reports, and adopts his/her research motivated by own and clinical expectations and needs, and as a result, stimulates the development and the effects of innovation.

Moreover, the training of specialists in clinical leadership contributes to the evolution and improvement of the healthcare system.

5.D. The Continuing Education.

It is no longer acceptable for any professional to abstain from the continuing education following obtaining qualifications in modern healthcare. This is particularly true in laboratory medicine, due to a true explosion of technological innovations and changes in the organization, the number and types of tests, as well as the role of medical laboratories. The continuing education ensures skills, competencies, and motivation of laboratory staff that meet the requirements of the medical services.

The continuing education courses should use a formula in which specialists apply critical reasoning, communication, and collaborative skills, develop knowledge and skills by actively solving problems and building conceptual frameworks, explore carefully designed questions which integrate content from across the laboratory disciplines.

Training objectives should include a broad understanding of the principles of novel and advanced analytical techniques used in laboratory diagnostics. Participants gain the knowledge of and the insight into the use and limitations of technology and analytical methods, as well as appreciate technological developments with innovative and creative approaches to their implementation.

Moreover, specialists become familiar with laws, regulations, guidelines, and recommendations regarding the work in clinical laboratories: in particular, the requirements for accreditation of services, education, and training, health and safety, infection control, regulation, and registration of staff.