

«Krok-1. Medicine» in Bogomolets National Medical University as Education Indicator

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Abstract: The quality assurance system implemented for higher medical education in Ukraine at the sectoral level includes the ranking of higher medical institutions and national licensed integrated examinations (hereinafter - LIE), which have been implemented since 1998. The LIE system is a set of tools for standardized diagnostics of the level of professional competence as part of the state certification of students majoring in "Medicine", "Stomatology" and "Pharmacy" in higher education, regardless of their subordination. The purpose of the licensed integrated exam is to establish compliance with the level of professional competence of the graduate with the minimum required level by the requirements of the State Standards of Higher Education. Professional competence is diagnosed as the ability to apply knowledge and understanding of fundamental medical disciplines. The study is devoted to analysis of students' readiness to the licensing integrated examination "Krok-1. Medicine" in Ukraine 2019 year. The scores of O. O. Bogomolets National Medical University (hereinafter - NMU) students were examined in more details in comparison to the results of students from other high medical schools of Ukraine. The results of licensing integrated examination "Krok-1. Medicine" were compared for students of medical #1-4 faculties, the medical-psychological faculty and faculty for training doctors for the armed forces of Ukraine. The results of students were analyzed by subtests, which are included to licensing integrated examination "Krok-1. Medicine". It was shown that NMU 4.8% generally gives better than the average performance indicator in Ukraine among all medical universities. Conducting an analysis of the success of the medical faculties of NMU, it can be noted that the medical #1 and #2 faculties showed the highest results: 78.7% and 78.3% respectively.

Keywords: Licensing Integrated Exam "Krok-1. Medicine", O. O. Bogomolets National Medical University, Analysis of Results, Faculty Development, Interdisciplinary Medical Education

1. Introduction

The national strategy of development of education in Ukraine on a period to 2021, that is approved by Decree of President of Ukraine from 25.06.2013 № № 344/2013 [1], among basic tasks determines the development of thinking, oriented to the future, further modernization and development of education on European principles, upgrading of the quality of education on the innovative basis.

After the Bologna process had been adopted, Ukraine reformed its education system, thus adapting it to European Union standards. The quality assurance system implemented

for the higher education of Ukraine at the sectoral level includes the rating of higher medical institutions and national licensed integrated examinations (here and after - LIE), which have been implemented since 1998 by the State Organization "Center for Testing the Professional Competence of Professionals with Higher Education in the Areas of Training "Medicine" and "Pharmacy" at the Ministry of Health of Ukraine [2].

The Regulations on the licensing exam system, approved by the order of the Ministry of Health of Ukraine of 25.08.1998 №251, for the first time normalized the system of quality assurance of medical education at the expense of LIE "Krok", in the direction "Medicine", "Dentistry" and

"Pharmacy". The LIE system is a complex of means standardized diagnostic of the level of professional competence, which is an integral part of the state certification of students studying in the specialties of the fields of preparation "Medicine", "Dentistry" and "Pharmacy", and doctors (pharmacists) who have primary specialization (internship), in higher education institutions regardless of their subordination.

The purpose of the licensed integrated examination is to establish the level of professional competence of the graduate (intern) to the minimum required level following the requirements of the State Higher Education Standards [3]. Professional competence is diagnosed as the ability to apply the knowledge and understanding of the basic biomedical sciences and basic medical disciplines, which are the most important for providing care to the patient under the surveillance of a more experienced physician. The focus is on maintaining health, preventing disease and organizing timely quality care.

The methodology or methodology that is the basis of the construction of the LIE was discussed at numerous All-Ukrainian seminars with the participation of representatives of all medical educational institutions of different ownership and subordination. It was at the expense of comprehensive discussion and support of the proposed technologies of LIE that led to the implementation of a unified standardized system for assessing the professional competence of each applicant for medical education, which is normalized by the order of the Ministry of Health of Ukraine of December 31, 1996 №396. All higher educational institutes of Ukraine, that provide training in the fields of "Medicine", "Dentistry" and "Pharmacy" joined this event.

LIE "Krok", which is used in Ukraine, have also undergone professional expertise in the world's leading certification centers, namely: the National Board of Medical Examiners (NBME, USA), the Center for Medical Education (CME, England), and the Institute of Content and Learning Methods of MES of Ukraine, Institute of Pedagogy and Psychology of Professional Education of APS of Ukraine. At the decision of the World Conference, the Licensing Examination Program of Ukraine was recommended to other countries that introducing licensing or certification exams as a model for use [4].

The Testing Center for International Expertise also actively cooperates with various international organizations that support projects, that help to develop a democratic, open society in Ukraine. Industry higher education standards determine that the "Krok-1" test exam measures the quality of basic higher education, and the "Krok-2" test exam is part of the state certification of university graduates (HEIs) and measures the quality of a professional higher medical education. The "Krok-1" licensing exam is conducted in the form of a written test and consists of 200 A-format tests, which have undergone professional expertise [5].

Among the goals of testing, no less significant than determining the student's level of knowledge are the following:

- 1) highlighting and concentrating students' attention to the most important components of the educational material;
- 2) motivation of students to study;
- 3) identification of gaps in educational programs;
- 4) identifying sections and disciplines that need attention in preparation.

The main criterion for determining the degree of effectiveness of any test is its validity in content, the degree of conformity of certain knowledge and the ability to apply them. Knowledge acquirement involves a program of a certain scientific discipline.

In the pedagogical literature, the quality of knowledge is determined based on such parameters as strength, completeness, depth, efficiency, flexibility. The strength of knowledge is associated with the length of memory of the learned educational material, which is characterized by completeness, easiness and error-free reproduction. Completeness is determined by the number of acquired elements of knowledge that relate to the object of learning cognition, defined based on the education program. The depth of knowledge is characterized by the number of students' significant connections and understanding of the material learned. Flexibility involves the acquisition of skills and practical skills in non-standard situations, which is determined by the level of learning [6].

2. Literary Review

Introducing independent evaluation of applicants for higher medical education is one of the main achievements of the use of the credit-module system for the organization of the educational process and the European Credit Transfer System [7]. The result of students taking licensing exams is an important rating of the quality of the educational process in higher medical (pharmaceutical) institutions. Therefore, the "Krok-1" Licensed Integrated Exam is a reflection of the students' level of knowledge in basic disciplines, which includes the discipline of 1-3 courses: human anatomy; biology; biological chemistry; histology, cytology, and embryology; virology and immunology; physiology; pathological physiology; pathological morphology; pharmacology. A high correlation between academic success and the results of the passing of the "Krok-1" LIE is noted by both Ukrainian and foreign researchers. There is a high correlation between exam results from all first and second-year educational programs and marks of the United States Medical Licensing Examination (USMLE) Step 1 [8].

A great number of researches has been devoted to the relationship between USMLE and Medical College Admission Test (MCAT) results, which show a high correlation between the MCAT Biological and Physical Sciences subtests and Step-1 scores [9].

The low level of knowledge of the majority of entrants causes their low academic success, which is reflected both during the passing the final module controls and on the "Krok-1" LIE [10-13]. Therefore, it is of great importance for students to perform the test tasks offered by the Testing

Center and to solve the situational tasks and clinical cases built based on these test tasks [14]. Holding lectures and consultations on subjects covered by this exam during the preparation of students for “Krok-1” provides students with the opportunity to repeat the material already learned, to understand the connections between individual sections of the discipline and interdisciplinary communications [15]. One of the factors promoting the improvement of the success of medical students in the preparation of “Krok-1” LIE is to determine the index of complexity of tests on each topic and to consider typical mistakes during pretesting when the introductory lectures are preparing. [16].

Significantly improves the results of the preparation of “Krok-1” LIE as well as the control of students' independent preparation for the exam using the Moodle distance learning system [17]. The implementation of several intermediate controls makes it possible to evaluate the dynamics of students' independent work during preparation for the “Krok-1” LIE [18].

The research has shown that students consider self-control to be the most effective way of controlling the preparation for licensing exams, which most students prefer to test using an online test system that can be accessed remotely by computer classrooms; the test system, after passing the test, allows getting acquainted with the correct answers and to understand which sections of the training material should be given more attention during preparation [19].

3. The Purpose and Objectives of the Research

The purpose of this research is to analyze the results of the preparation of the licensed integrated examination “Krok-1”

by students of higher medical (pharmaceutical) educational institutions of Ukraine and to compare the success of students of different years of study, specialties, and faculties of the Bogomolets National Medical University with national rates.

To achieve this goal, the following tasks were set:

1. To analyze the results of passing the LIE “Krok-1. Medicine” in 2019 by Ukrainian students, as well as foreign students of Russian-speaking and English-speaking forms of study at higher medical institutions of Ukraine.

2. Compare the success of passing the LIE “Krok-1. Medicine” by the students of the Bogomolets National Medical University in recent years.

3. To explore changes in national rates of the passing the LIE “Krok-1. Medicine” by subtests in recent years.

4. To compare the success of passing the LIE “Krok-1. Medicine” by the subtests of the students of the Bogomolets National Medical University in recent years.

5. To compare the level of successful passing the “Krok-1” LIE in 2019 by subtests of students of different specialties and different faculties of the Bogomolets National Medical University.

4. Results and Discussion

4.1. Analysis of the Results of the Passing the “Step 1. Medicine” LIE by the Students-citizens of Ukraine

On June 25, 2019, the Licensed Integrated Examination “Krok-1. Medicine” was held in 21 higher educational institutions (HEIs). The list of HEIs, whose students participated in the licensed integrated exam “Krok-1. Medicine” is presented in *Table 1*.

Table 1. List of universities participating in the licensed integrated exam “Krok-1. Medicine”.

Abbreviation of HEI		Full title of higher education institutions
Higher education institutions of the Ministry of Health of Ukraine		
1	BSMU	Bukovinian State Medical University
2	VNMU	National Pirogov Memorial Medical University, Vinnytsya
3	DMA	Dnipropetrovsk Medical Academy
4	DNMU	Donetsk National Medical University
5	ZSMU	Zaporizhzhia State Medical University
6	IFNMU	Ivano-Frankivsk National Medical University
7	LSMU	Luhansk State Medical University
8	LNMU	Danylo Halytsky Lviv National Medical University
9	NMU	Bogomolets National Medical University
10	ONMU	Odessa National Medical University
11	TNMU	I. Horbachevsky Ternopil National Medical University
12	UMSA	Ukrainian Medical Stomatological Academy
13	KNMU	Kharkiv National Medical University
Medical faculties of higher education institutions of the Ministry of Education of Ukraine		
1	UzhNU	Uzhhorod National University
2	SumSU	Sumy State University
3	KhNU	Khmelnitskyi National University
4	PMBSNU	Petro Mohyla Black Sea National University
Private higher education institutions		
1	KMU	Kyiv Medical University
2	DMITNM	Dnipro Medical Institute of Traditional and Non Traditional Medicine
3	IAEM	International Academy of Ecology and Medicine
4	LMI	Lviv Medical Institute

The exam was conducted in accordance with the branch standard of higher education of educational qualification level “specialist” in the field of knowledge 22 “Health care” in specialties 222 – “Medicine”, 225 – “Medical-psychological business”, 228 – “Pediatrics” of the of the current curriculum, approved and put into effect by the order of the Ministry of Health of Ukraine dated 07.12.2009 No. 929 (with changes according to the order of the Ministry of Health of Ukraine of 54.07.2010 No. 541), and the order of the Ministry of Health of Ukraine of 25.08.1998 No. 251 “On Approval of the Regulation on the System of Licensed Integrated Examinations of Specialists higher education in the directions Medicine”. The criterion “passed / failed” was set at the level of 60,5% of the correct answers by the letter of the Ministry of Health of Ukraine dated June 19, 2014, No. 08.01-4716977 [20].

“Krok-1. Medicine” licensing exam has the status of a semester exam, which provides for the possibility of retake it not more than twice during the semester.

According to the higher education institutions, 8040 students of Ukraine were registered, including 4609 students of budgetary and 3431 students of contract forms of study; 467 foreign students with Russian (or Ukrainian) language of study and 4400 foreign students with English language

education.

The exam was 7723 students from Ukraine, of which 4512 students of budgetary and 3211 contracted forms of study; 426 foreign students of Russian (and Ukrainian) language of study and 4218 foreign students of English-language education [20].

Among the Ukrainian students, the exam “Krok-1. Medicine” did not pass 1337 persons out of 7723, which is 17.3%. Of the 21 HEIs that participated in the test, at 11 HEIs, the number of students who failed the exam does not exceed the national average (*figure 1*). Among 417 DMA students, 21 students did not pass the exam, which is 5.0%, NMU - the exam did not pass 88 students out of 1024, which is 8.6%, LNMU - the exam did not pass 62 students out of 555, which is 11.2%, IFNMU - the exam did not pass 49 students out of 432, which is 11.3%, SumSU - the exam did not pass 20 students out of 174, which is 11.5%, TNMU - the exam did not pass 56 students out of 455, which is 12.3%, KNMU - the exam did not pass 65 students out of 486, 13.4%, BSMU - the exam did not pass 58 students out of 428, which is 13.6%, ZSMU - the exam did not pass 82 students out of 559, which is 14.7%, UMSA - the exam did not pass 69 students out of 427, which is 16.25%, VNMU - the exam did not pass 123 students out of 742, which is 16.6% [20].

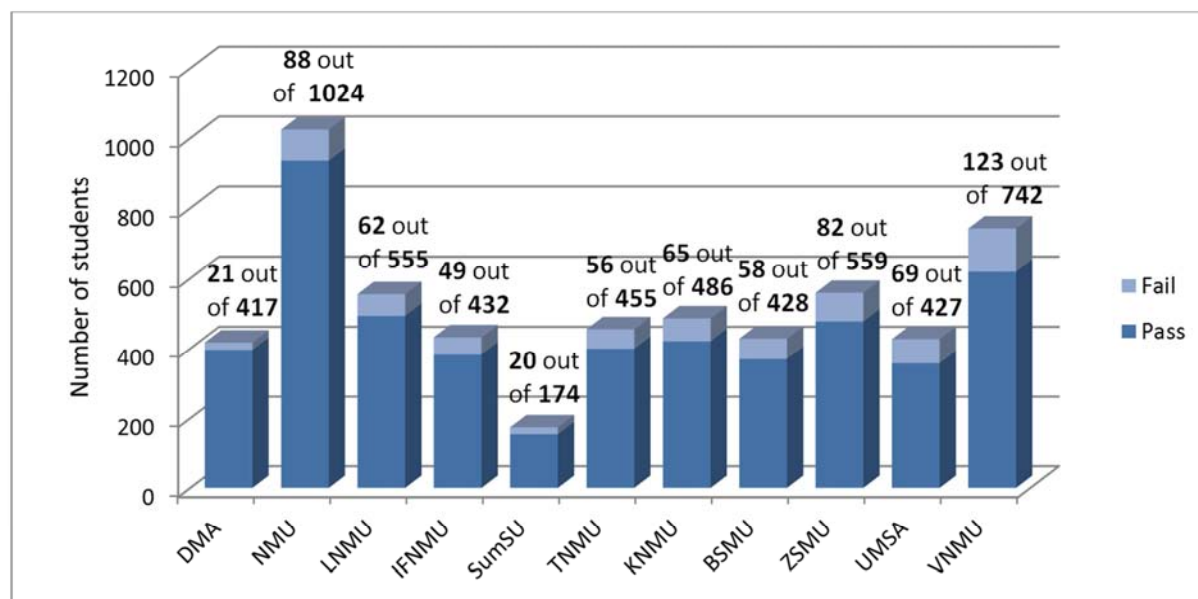


Figure 1. The results of passing the licensing exam “Krok-1. Medicine” by Ukrainian students in 11 HEIs (the number of students who did not pass the exam does not exceed the national average).

Among the other HEIs that participated in the test, the number of students who failed the exam was lower than the national average (*figure 2*). Of ONMU students the exam did not pass 116 out of 572, which is 20.3%; LMI – the exam did not pass 12 out of 55 students, which is 21.8%; DNMU - the exam did not pass 135 out of 529 students, which is 25.5%; UzhNU – the exam did not pass 65 out of 251 students, which is 25.9%; IAEM - 13 of 40 students failed the exam,

which is 32.5%; KhNU – the exam did not pass 47 out of 121 students, which is 38.8%; LSMU – the exam did not pass 59 out of 137 students, which is 43.1%; DMITNM – the exam did not pass 11 out of 19 students, which is 57.9%, KMU – the exam did not pass 122 out of 204 students, which is 59.8%; PMBSNU – the exam did not pass 64 out of 96 students, which is 66.7%.

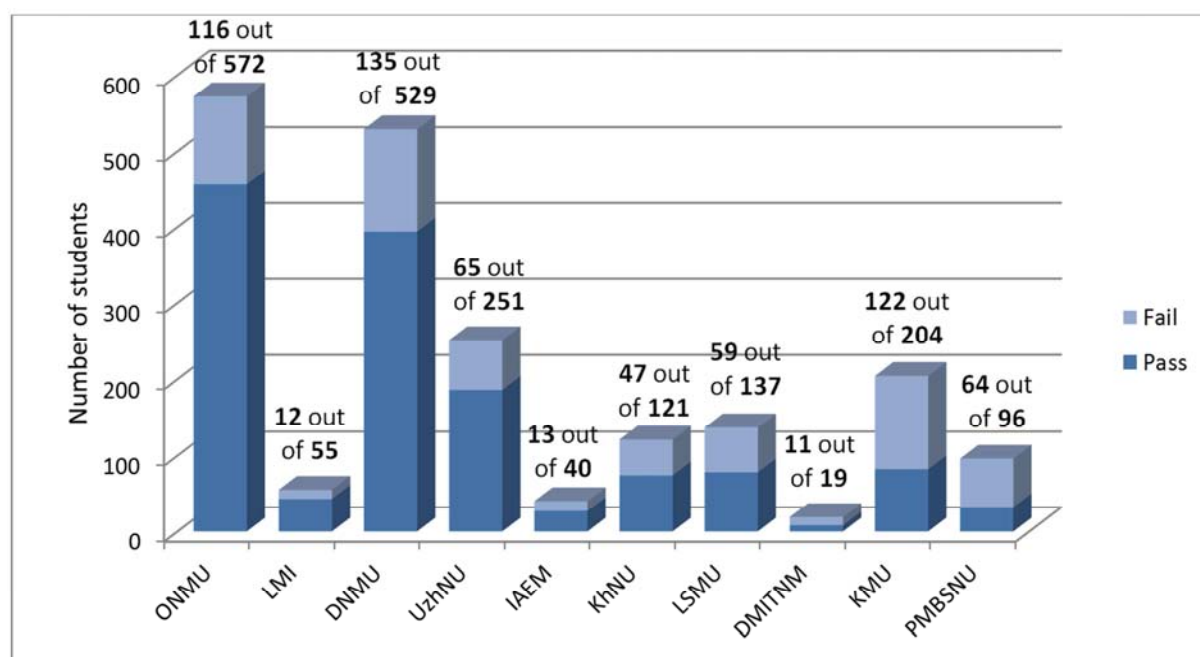


Figure 2. The results of passing the licensing exam "Krok-1. Medicine" by Ukrainian students in 10 HEIs (the number of students who fail the exam exceeds the national average).

There is a significant difference between the results of the examination of students of budgetary and contract forms of study: out of 4512 students of a budgetary form of the study did not pass 310, which is 6.9%, and out of 3211 students of contract form of the study did not make 1027 - 32.0%. The data on the results of the passing of students from different HEIs of Ukraine is given in *Table 2*.

Table 2. Number of Ukrainian students of budgetary and contract forms of education who did not passed the licensing exam "Krok-1. Medicine"

No.	HEIs	Number of students, who took the exam		Number of students, who DID NOT PASS the exam			
		budgetary form	contract form	budgetary form	%	contract form	%
1.	BSMU	199	229	5	2.5	53	23.1
2.	VNMU	434	308	21	4.8	102	33.1
3.	DMA	353	64	6	1.7	15	23.4
4.	DNMU	426	103	79	18.5	56	54.4
5.	ZSMU	311	248	16	5.1	66	26.6
6.	IFNMU	212	220	8	3.8	41	18.6
7.	LSMU	109	28	37	33.9	22	78.6
8.	LNMU	352	203	11	3.1	51	25.1
9.	NMU	701	323	21	3.0	67	20.7
10.	ONMU	312	260	28	9.0	88	33.8
11.	TNMU	190	265	5	2.6	51	19.2
12.	UMSA	214	213	9	4.2	60	28.2
13.	KNMU	390	96	26	6.7	39	40.6
14.	KMU	0	204	0	0.0	122	59.8
15.	UzhNU	132	119	19	14.4	46	38.7
16.	SumSU	123	51	7	5.7	13	25.5
17.	KhNU	29	92	2	6.9	45	48.9
18.	DMITNM	0	19	0	0.0	11	57.9
19.	IAEM	0	40	0	0.0	13	32.5
20.	LMI	0	55	0	0.0	12	21.8
21.	PMBSNU	25	71	10	40.0	54	76.1
22.	Total:	4512	3211	310	6.9	1027	32.0

In 2019, the number of students who did not pass the exam in Ukraine and at NMU improved compared to 2017 and 2018, as can be seen from the *Table 3*.

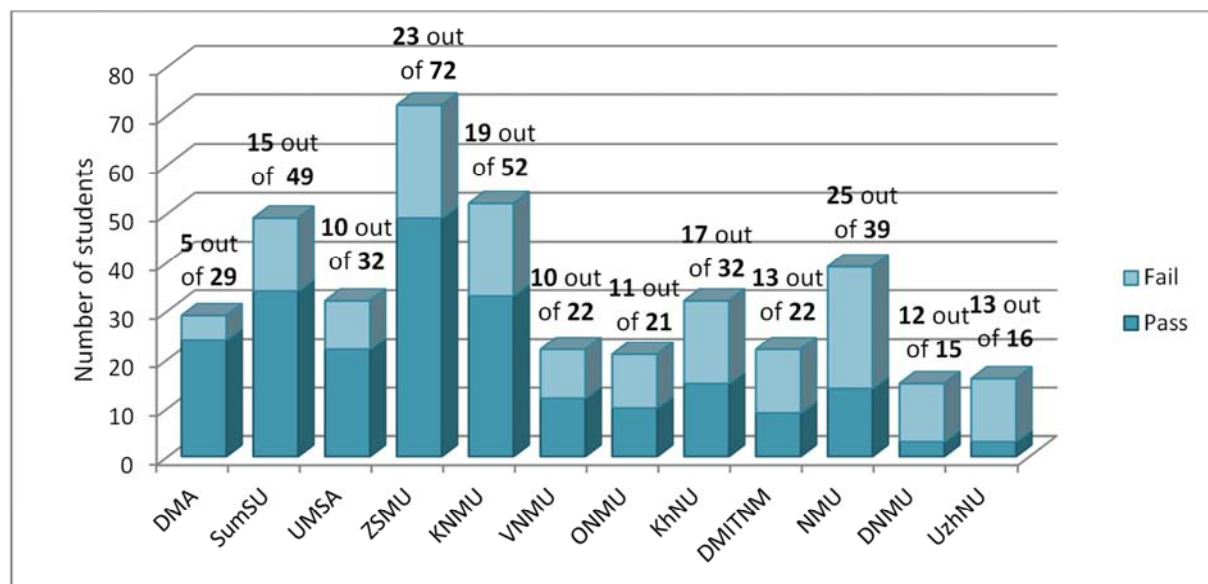
Table 3. An average number of students-citizens of Ukraine and students of NMU who did not pass the exam.

	HEIs of Ukraine		NMU	
	number of students	national average	number of students	average
2017 year	1400 out of 7918	18.4%	151 out of 1035	14.6%
2018 year	1494 out of 7805	19.1%	114 out of 1003	11.4%
2019 year	1337 out of 7723	17.3%	88 out of 1024	8.6%

In 2017, the national average of Ukrainian students who failed the exam is 18.4%, in 2018 it is 19.1%. In the NMU this indicator in 2017 is 14.6%, in 2018 - 11.4% [11-13]. The national average in Ukraine have fluctuated over the last three years: in 2018 compared to 2017, the performance of Ukrainian students has decreased by 0.7%, but in 2019 it increased by 1.8%. Success rates of students of Bogomolets National Medical University tend to grow: in 2018 they improved by 3.2% and in 2019 by another 2.8%.

4.2. Analysis of the Results of the Passing the “Krok-1. Medicine” LIE by Foreign Students

Among foreign students with Ukrainian language of study the exam “Krok-1. Medicine” did not pass 189 out of 426 persons, which is 44.4%. In *figure 3* are the results of foreign students of Russian-speaking form of study who failed the “Krok-1. Medicine” LIE (generalized results are presented for HEIs in which the number of students participating in the exam is greater than 10) [20].

**Figure 3.** The results of passing the licensing exam “Krok-1. Medicine” by students of foreign countries studying in Ukrainian.

Of the 19 HEIs that took part in the test, in 8 HEIs the number of students who failed the exam does not exceed the national average: BSMU and TNMU (all 4 students successfully passed the exam), DMA (5 students who did not take the exam is 17.2%), KMU (exam did not pass 1 student out of 4, which is 25.0%), SumSU (exam did not pass 15 students, which is 30.6%), UMSA (exam did not pass 10 students, which is 31.3%), ZSMU (exam did not pass 23 students, which is 31.9%), KNMU (exam did not pass 19

students, which is 36.5%).

Among other universities, including the Bogomolets NMU, which took part in the test, the rate of the number of students, who failed the exam, is worse than the national average [20].

In 2019, the number of students from foreign countries studying in Russian (Ukrainian) and students of Bogomolets National Medical University, who failed the exam, improved compared to 2017 and 2018, as can be seen from the *table. 4*.

Table 4. An average number of students from foreign countries, studying in Russian (Ukrainian), and students of Bogomolets National Medical University, who did not the exam.

	HEIs of Ukraine		NMU	
	number of students	national average	number of students	average
2017 year	686 (944)	72.7%	35 (44)	79.5%
2018 year	447 (665)	67.2%	34 (45)	75.6%
2019 year	189 (426)	44.4%	25 (39)	64.1%

In 2017, the average number of students from foreign countries studying Russian (Ukrainian) who failed the exam

was 72.7%, in 2018 - 67.2%. In Bogomolets National Medical University in 2017 this rate was 79.5%, compared

with 75.1% in 2018 [11-13]. Performance indicators in Ukraine and Bogomolets National Medical University are completely correlated with each other. The performance indicators of foreign students studying in Russian (Ukrainian) in 2019 improved by 22.8% compared to 2018, and by 28.3% compared to 2017. The performance indicators of Bogomolets National Medical University students improved by 11.5% and 15.4% respectively.

Among the foreign students studying in English, the exam "Krok-1. Medicine" did not pass 1437 out of 4218 persons, which is 34.1%.

Of the 19 HEIs that participated in the test, at 10 HEIs, the number of students who failed the exam does not exceed the

national average: SumSU (exam did not pass 11 students, which is 12.0%), BSMU (exam did not pass 37 students, which is 13.2%), KNMU (exam did not pass 94 students, which is 17.3%), IFNMU (exam did not take 19 students, 20.0%), TNMU (33 students did not pass the exam, 23.9%), ZSMU (58 students did not take the exam, which is 25.1%), DMA (31 students did not take the exam, which is 25.2%), KhNU (144 students did not pass the exam, which is 25.4%), VNMU (exam did not pass 52 students, which is 26.4%), LNMU (exam did not pass 39 students, which is 29.1%).

Figure 4 shows the results of foreign students of English-speaking form of education who did not pass the "Krok-1. Medicine" LIE [20].

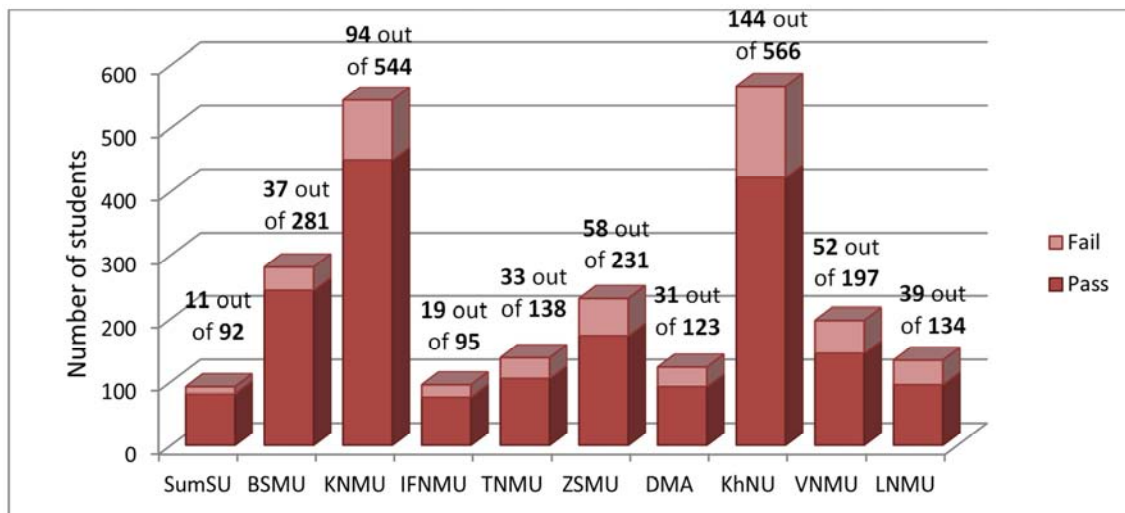


Figure 4. The results of passing the licensing exam "Krok-1. Medicine" by students from foreign countries studying in English, in 10 HEIs (the number of students who did not pass the exam does not exceed the national average).

Among other HEIs that participated in the test, the number of students who failed the exam is worse than the national average (figure 5). Among students of UMSA, who did not pass exam -28, which is 41.8%, KMU - exam did not pass 57 students, which is 43.2%, UzhNU - exam did not pass 146 students, which is 46.5%, ONMU - exam did not pass 248

students, which is 46.8%, DMITNM - exam did not pass 123 students, which is 50.2%, NMU - exam did not pass 133 students, which is 55.2%, DNMU - exam did not pass 115 students, which is 57.8%, IAEM - exam did not pass 17 students, is 73.9%, LSMU - exam is not passed by 52 students, which is 78.8% [20].

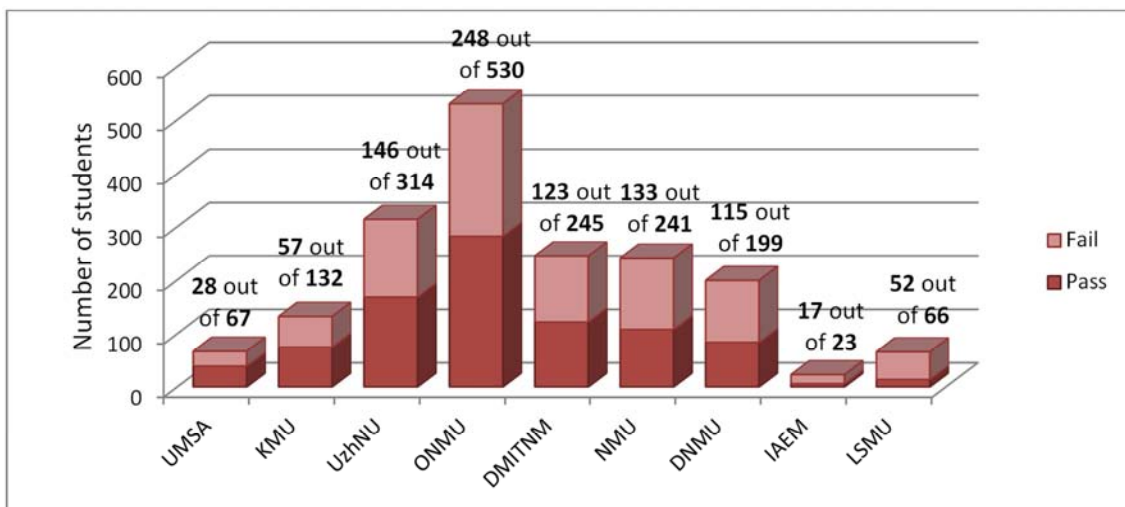


Figure 5. The results of passing the licensing exam "Krok-1. Medicine" by students from foreign countries studying in English, in 9 HEIs (the number of students who fail the exam exceeds the national average).

In 2019, the number of foreign students studying in English, who have failed the exam, has improved compared to 2017 and 2018, and students of Bogomolets National

Medical University this rate worsened, as can be seen from the *Table 5*.

Table 5. An average number of students of foreign countries studying in English and students of NMU, who did not pass the exam.

	HEIs of Ukraine		NMU	
	number of students	national average	number of students	average
2017 year	1120 (2502)	44.8%	74 (151)	49.0%
2018 year	1471 (3050)	48.2%	76 (148)	51.4%
2019 year	1437 (4218)	34.1%	133 (241)	55.2%

In 2017, the average number of students from foreign countries, who study in English and failed exams was 44.8%, in 2018 - 48.2%. In the Bogomolets National Medical University, this rate was 49.0%, compared to 51.4% in 2018 [11-13].

As can be seen from *Table 5*, the success rates in Ukraine have fluctuated over the last three years: in 2018 compared to 2017, the success of English-speaking foreign students has worsened by 3.4%, but increased by 14.1% in 2019. Rates of success of students of NMU tend to fall: in 2018 they have worsened by 2.4% and in 2019 - by another 3.8%.

In conclusion, it is worth noting that foreign students studying in English are better at taking the licensing exam "Krok-1. Medicine" than foreign students studying in Russian (Ukrainian).

4.3. Analysis of the Results of the Passing the "Krok-1. Medicine" LIE by the Students of Bogomolets National Medical University

The results of the passing of the licensed integrated examination "Krok-1. Medicine" by Ukrainian students by subtests in 2019 is analyzed.

In *figure 6* is shown the dynamics of changes in the results of the passing the "Krok-1. Medicine" by Ukrainian students by subtests: biology, normal anatomy, histology, pathological physiology, the result of which in 2019 has improved compared to previous years [11-13]. In recent years, the results of passing the LIE Biology and Biochemistry subtests have been steadily increasing.

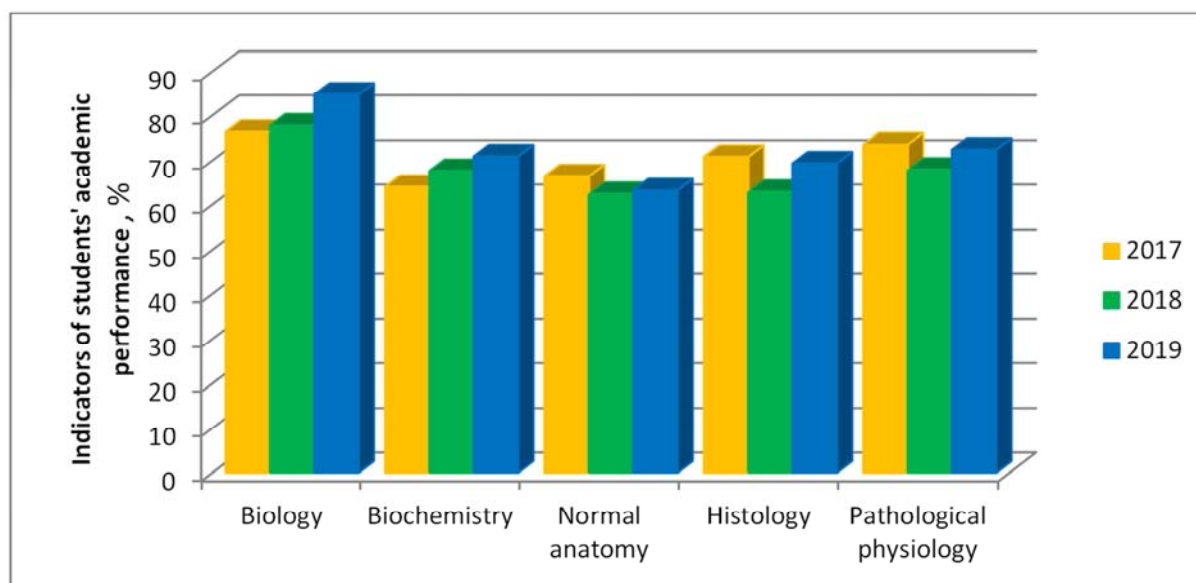


Figure 6. The results of the passing the "Krok-1. Medicine" LIE by Ukrainian students by subtests, the results of which have improved in 2019.

The indicators of students' academic performance in some disciplines improved: biology (increased by 7%), normal anatomy (increased by 0.8%), histology (increased by 6.4%), biochemistry (increased by 3.3%), pathological physiology (increased by 4.5%).

Improved in 2019, but did not reach the level of 2017 results of passing by the Ukrainian students subtests of such disciplines such as normal anatomy, histology, and

pathological physiology.

For such subjects as normal physiology, pathological anatomy, microbiology, pharmacology, Ukrainian students showed worse results, the rate of passing decreased by 1.3%, 5.3%, 3.5%, and 5.6%, respectively. In *figure 7* is shown the dynamics of changes in the results of the passing the "Krok-1. Medicine" LIE by Ukrainian students for these subtests in 2017-2019 [11-13].

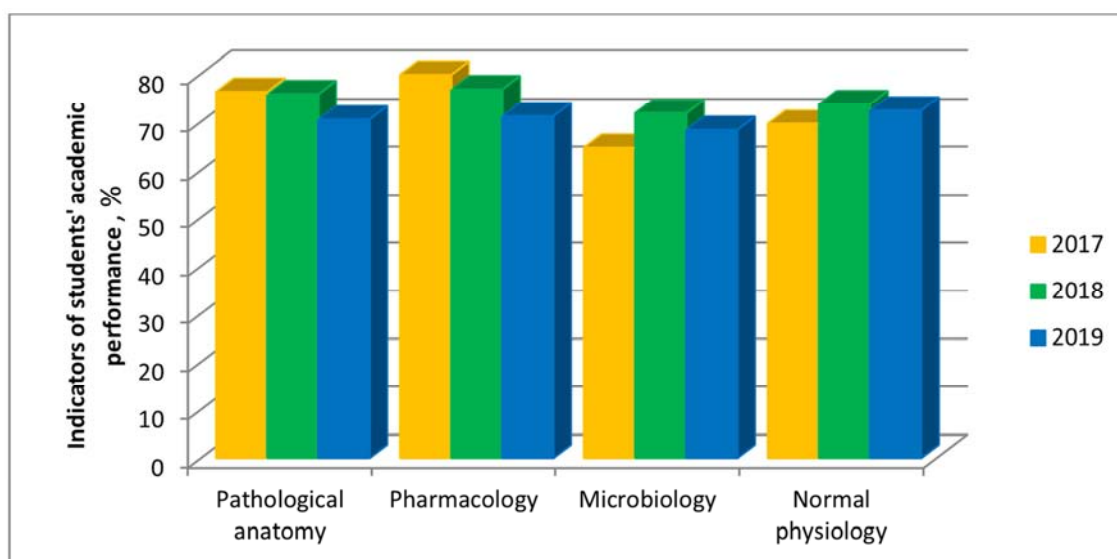


Figure 7. The results of the passing the "Krok-1. Medicine" LIE by Ukrainian students for subtests, whose results worst in 2019.

In recent years, the results of the passing the pathological anatomy and pharmacology by Ukrainian students have been steadily declining. Compared to 2018, the results of passing the normal physiology and microbiology by Ukrainian students have not worsened but did not decrease to the level in 2017.

Consider the results of the passing the «Krok-1. Medicine»

LIE by the students of the 3rd year of the Bogomolets National Medical University in 2019. In the table 6 are presented the results of the «Krok-1. Medicine» LIE by students-citizens of Ukraine of the Bogomolets National Medical University for the last three years by the subtests [11-13].

Table 6. The results of the passing "Krok-1. Medicine" LIE by students of NMU (Ukrainian-speaking form of education) by the subtests.

Disciplines	Indicators of NMU students' academic performance		
	in 2017, %	in 2018, %	in 2019, %
General indicator	73.4	75.0	76.0
Biology	78.4	80.4	88.3
Normal anatomy	68.8	67.8	64.9
Histology	71.3	66.9	72.3
Normal physiology	72.6	78.7	76.8
Biochemistry	64.3	70.8	77.2
Pathological physiology	77.1	72.5	77.7
Pathological anatomy	80.2	82.0	78.9
Microbiology	61.8	69.6	69.2
Pharmacology	83.3	81.0	77.1

As can be seen from the Table 6 in general the results of passing the licensed integrated examination "Krok-1. Medicine" by the students of NMU is correlated with the national indicators of students' academic performance. It is also necessary to notice that the indicators of students' performance by the Bogomolets National Medical University is higher than the national one by all subtests [20]. Similar to the national indicators over the last three years, the indicators of students' performance of biology (by 2.0% in 2018 and by 7.9% in 2019) and biochemistry (by 6.5% in 2018 and by 6.4% in 2019) have increased. The indicators of students' performance of in histology and pathological physiology after decreasing (by 4.4% and 4.6%, respectively) in 2018 results improved above the level of 2017 - by 5.4% and 5.2%, respectively.

By the subtests of normal anatomy, normal physiology, pathological anatomy, microbiology and pharmacology, the

results of students of the Bogomolets National Medical University decreased compared to 2018. Similar to the national indicators of students' academic performance over the last three years, the indicators of NMU students' performance of normal anatomy (by 1.0% in 2018 and by 2.9% in 2019) and pharmacology (by 2.3% in 2018 and by 3.9% in 2019) have decreased. Indicators of students' performance of normal physiology and microbiology after improvement by 6.1% and 7.8% in 2018, slightly worsened (by 1.9% and 3.9%, respectively). Only academic performance indicators of NMU students in pathological anatomy differ from national ones - after an improvement of 2.2% in 2018, there was a deterioration below the level of 2017 - by 3.1%.

In conclusion, it can be noted that students of NMU in comparison with the national rate show better results of passing the LIE in such disciplines as biology, normal physiology, biochemistry, pathological physiology. Indicators

of students' academic performance of disciplines such as microbiology, pathological anatomy and pharmacology have decreased but remain higher than the national rate. Most likely, the complexity of the test tasks was high. And indicator of students' academic performance of normal anatomy by the students of the 3rd year of NMU worsened by 2.9% compared to the improvement of the national index in this discipline by 0.8%. This fact indicates that the

students were not well trained in this discipline.

Consider the results of passing the licensed integrated examination “Krok-1. Medicine” by Ukrainian students of the 1st, 2nd, 3rd and 4th medical faculties, medical-psychological faculty and faculty of training doctors for the armed forces of Ukraine (FTDAFU) of the Bogomolets National Medical University are shown in *Table 7*.

Table 7. The results of the passing of “Krok-1. Medicine” LIE by students of NMU 1st – 4th medical faculties, medical-psychological and FTDAFU.

No	Faculty	Number of students	Test (%)	Subtests (%)				
				Biology	Normal anatomy	Histology	Normal physiology	Biochemistry
1	National indicator	7723	71.2	84.7	63.2	69.3	72.4	70.9
2	NMU	1024	76.0	88.3	64.9	72.3	76.8	77.2
3	1 st medical	349	78.7	90.3	67.1	74.7	79.1	79.9
4	2 nd medical	331	78.3	91.0	67.9	74.1	79.2	79.6
5	3 rd medical	129	68.8	84.1	58.6	65.4	68.8	70.4
6	4 th medical	185	72.8	83.5	61.0	71.3	74.3	73.0
7	FTDAFU	19	74.7	86.3	61.4	66.9	73.5	78.0
8	Medical-psychological	11	66.8	73.6	54.5	53.2	69.2	64.5

Table 7. Continued.

No	Faculty	Number of students	Test (%)	Subtests (%)			
				Pathological physiology	Pathological anatomy	Microbiology	Pharmacology
1	National indicator	7723	71.2	72.4	70.5	68.3	71.2
2	NMU	1024	76.0	77.7	78.9	69.2	77.1
3	1 st medical	349	78.7	80.0	82.0	72.5	80.4
4	2 nd medical	331	78.3	80.8	80.6	70.9	78.2
5	3 rd medical	129	68.8	68.8	70.8	60.7	71.2
6	4 th medical	185	72.8	74.8	76.2	65.7	73.4
7	FTDAFU	19	74.7	77.6	76.6	71.9	76.0
8	Medical-psychological	11	66.8	63.6	75.3	65.2	73.7

As can be seen from *Table 7*, Ukrainian students of 1st - 4th medical faculties and FTDAFU of the Bogomolets National Medical University have passed “Krok-1. Medicine” LIE above the level of the national indicators of Ukraine, and medical-psychological faculty - below the level of the national indicators. The indicators of students' academic performance NMU is 4.8% higher than the national one. If we consider the results of passing the exam between the medical faculties of NMU, it can be seen from *Table 7* that the 1st medical faculty has the highest results in all subtests, it is almost inferior to the 2nd medical faculty. The 3rd medical faculty did not pass a discipline as “normal anatomy”: 58.6%, which is lower than the rate of passing, established by the Ministry of Health of Ukraine as an absolute criterion “passed/failed” - 60.5% of the correct answers. According to many subtests, the results of this faculty are below the national, but within the established criterion “passed/failed”: from microbiology - by 7.6%, from histology - by 3.9%, from normal and pathological physiology - by 3.6%, from biology - by 0.6%, from biochemistry - by 0.5%. The academic performance indicators of students of the 4th medical faculty of biology, normal anatomy and microbiology are lower than national ones by 0.6%, 2.2% and 2.6% respectively, but within the established criterion “passed/failed”. The FTDAFU showed results below the national average only in normal anatomy - by 1.8% and in

histology - by 2.4%.

The medical-psychology faculty was less successful in 2019: the indicators of students' academic performance was 66.8%, which improved by 4.5% compared to 2018 (62.3%). The medical-psychology faculty did not pass such disciplines as “normal anatomy” (6.0% lower than the set criterion) and “histology” (7.3% lower than the set criterion). Compared to 2017 and 2018, the medical-psychology faculty has become more successful as a result of passing “Krok-1. Medicine” LIE [11-13].

5. Conclusions

In the conducted research the results of the passing of the “Krok-1. Medicine” LIE in 2019 by students-citizens of Ukraine of higher educational institutions of Ukraine were analyzed.

Also, the success of passing the exam by students of Bogomolets National Medical University was analyzed for the last three years. To evaluate the changes of national rates of passing the “Krok-1. Medicine” LIE, the student results have been analyzed for the last three years, based on the subtest results in 2017-2019.

The success rate of passing the “Krok-1. Medicine” LIE in 2019 by subtests of students of different specialties and different faculties of NMU, the analysis of the results is

given in the form of analytical tables.

The successful passing the “Krok-1. Medicine” LIE provides for:

a) creation of a system of medical education of new generation according to time requirements, that provides for completeness of realization of function qualitative medical educations, outstripping general development of the human, that turns into the leading mechanism of reproduction of public intelligence, science, and culture.

b) improvement of quality of results of training of medical students, and also formations of competitiveness Ukrainian medical education due to ensuring fundamentality and practical orientation with educational and professional programs.

c) creation of the balanced legislative base of a system of medical education, that regulate and provide efficiency of realization of the strategic directions of development of medical education in Ukraine, productive functioning of all its subsystems.

d) Creation of positive samples and distribution of experience of successful reforming of medical education, providing necessary scientific and methodical, organizational and material conditions.

e) definiteness and streamlining of contents of all subsystems of education, that provide the settled system of knowledge and competences, the powerful professionally qualified personnel base for the economic growth of the state, competitiveness of domestic workers in foreign market of work.

Results of passing the “Krok-1. Medicine” LIE by students of National Medical University completely correlated with average values of passing over the country in recent years.

Therefore increase in the level of knowledge is possible only on condition of the coordinated work of pedagogical collective and independent work of students as during studying of disciplines, which are part of the “Krok-1. Medicine” LIE, and during the preparation for this exam.

Ethics Approval and Consent to Participate

Declaration of Helsinki were maintained.

Consent for Publication

Not applicable.

Availability of Data and Materials

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing Interests

All authors declare that they have no conflicts of interest.

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