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O. M. DenysiukORCID <https://orcid.org/0000-0002-0698-6945>**O. S. Pashynska**ORCID <https://orcid.org/0000-0001-5485-9898>**L. I. Marynych**ORCID <https://orcid.org/0000-0003-2191-3477>*M. Pyrohov Vinnytsia National Medical University***SIMULATION TRAINING AS A METHODOLOGICAL APPROACH TO TRAINING STUDENTS IN PHARMACOLOGY STUDYING****Н. І. Волощук, О. М. Денисюк, О. С. Пашинська, Л. І. Маринич***Вінницький національний медичний університет імені М. І. Пирогова***СИМУЛЯЦІЙНИЙ ТРЕНІНГ ЯК МЕТОДОЛОГІЧНИЙ ПІДХІД У ПІДГОТОВЦІ СТУДЕНТІВ ПРИ ВИВЧЕННІ ФАРМАКОЛОГІЇ**

Abstract. Nowadays simulation technologies are being actively implemented in the educational process of Ukrainian higher educational establishments both for students' education and for the assessment of their professional skills. In addition, simulation-based training can be a way of protecting healthcare professionals and patients from unnecessary risks and medical errors due to their lack of physician experience. But unfortunately, compared to other countries, ours is taking the first steps in this area, especially in the teaching of fundamental disciplines. This process requires new approaches to the teaching process for teachers and students. The purpose of our study was to substantiate methodological approaches to the effectiveness increase of pharmacology studies by third-year medical students via the introduction of simulating teaching methods. In preparation for the study content analysis using modern medical and scientific-pedagogical Internet sources, biblio-semantic, as well as analysis of final products of activity were used.

So, the Department of Pharmacology of M. Pyrohov Vinnytsia National Medical University developed a simulation situation on the topic "Anaphylactic shock. Pharmacological therapy" which is used in the educational process. The teachers and students noted out a high level of effectiveness of simultaneous mastering of theoretical material and practical skills in simulator-dummies. An important point in this methodological approach is to form the basis for clinical thinking development. Educational simulation can be considered as an important component of preparation for an objective structured clinical exam (OSCE).

Thus, using imitation technologies allows acquiring professional practical skills at a higher level than just theoretical, and helps to bring training in theoretical departments to practical medicine, allows transferring the acquired competencies to real clinical activity.

Key words: medical education; simulation training; practical skills; pharmacology teaching.

Анотація. На сьогодні в українських вищих медичних навчальних закладах симуляційні технології активно впроваджуються в освітній процес як для навчання студентів, так і для оцінки їх професійних навичок. Крім цього, навчання на основі моделювання може стати способом захисту медичних працівників та пацієнтів від непотрібних ризиків і лікарських помилок через

ки у цій сфері, особливо навчального процесу у викладачів і студентів. Мета нашого дослідження – обґрунтувати методичні підходи підвищення ефективності вивчення фармакології студентами III курсу медичного факультету через впровадження симуляційних методів навчання. При підготовці до дослідження було використано контент-аналіз із використанням сучасних медичних та науково-педагогічних Internet-джерел, бібліосемантичний, а також аналіз кінцевих продуктів діяльності.

На кафедрі фармакології Вінницького національного медичного університету ім. М. І. Пирогова була розроблена імітаційна ситуація за темою «Анафілактичний шок. Фармакологічна терапія», яка використовується в навчальному процесі. Викладачі та студенти відмічали високий рівень ефективності одночасного засвоєння теоретичного матеріалу та набуття практичних навичок на симуляторах-манекенах. Важливим моментом такого методологічного підходу є формування бази для розвитку клінічного мислення. Освітню симуляцію можна вважати важливою складовою підготовки до об'єктивного структурованого клінічного іспиту (OSCE).

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Таким чином, використання імітаційних технологій дозволяє оволодіти професійними практичними навичками на більш високому рівні, ніж лише теоретичний, та сприяє наблизити навчання на теоретичних кафедрах до практичної медицини, дозволяє перенести набуті компетенції в реальну клінічну діяльність.

Ключові слова: медична освіта; симуляційне навчання; практичні навички; викладання фармакології.

Introduction. The reform of the education system brings to the fore the problem of improving medical education. The development of cognitive activity in students requires the integration of traditional problem-searching methods with new forms of organization of the educational process, including technical facilities. One of the modern forms of teaching in medicine is the use of simulation technologies, with the help of which students can develop practical skills, which will allow them to switch to real interventions confidently [5, 9, 11].

Educational simulation is a well designed scenario of an event that includes a well-developed system of rules, objectives, strategies, and aims at generating specific competencies that can be transferred to the real world. Its use leads to improved mastering of the learning material (“applying” of knowledge and skills), as it increases the effectiveness of learning (the ability not only to hear, read, see, but also to make oneself) and the attractiveness of the learning process itself (simulation is often a role-playing game). Educational trainings allow to acquire the skills and abilities without fear to make a fatal mistake, help to learn and memorize training material in a comfortable emotional environment.

Nowadays this method of teaching is widely used by clinicians [3, 6, 10]. Unfortunately, the departments of fundamental disciplines do not make sufficient use of the potential of this methodological approach, giving preference to the theoretical analysis of material with separate elements of visual aids (diagrams, tables, figures). Therefore, the teaching staff of the Pharmacology Department of M. Pyrohov Vinnytsia National Medical University, together with the staff of VNMU Medical Simulation Center develop models of clinical situations that can be used to study the discipline of Pharmacology, in particular, in the treatment of urgent conditions. Thus, when studying the topics “Local anesthetics”, “Antibiotics” and “Anti-allergic agents”, it was suggested to work out a doctor’s algorithm for anaphylactic shock, which is known to be one of the most dangerous and fatal complications of pharmacotherapy [2].

The aim – to substantiate methodical approaches to increase the effectiveness of pharmacology studies by third-year medical students through the introduction of simulating teaching methods.

Methods. The experience of the Department of Pharmacology of M. Pyrohov Vinnytsia National Medical University, on the involvement of simulation training methods on simulator dummies is presented. Content analysis using modern medical and scientific-pedagogical Internet sources, bibliosemantic, final-product analysis was used.

Results. In order to fulfill this goal on the basis of VNMU Medical Simulation Center a simulation situation on the topic “Anaphylactic shock. Pharmacological therapy” was developed.

This type of training is divided into three consecutive and interrelated steps:

I – “Instruction” – defining the purpose and tasks, the role distribution with the explanation of the situation and the sequence of actions.

II – “Simulation” – direct execution of all planned actions and manipulations, the closest possible approach to the real situation.

III – “Re-briefing” – summarizing, analysis of what was heard, seen, performed, discussion of errors and their correction. Teacher’s assessment of students’ knowledge and success of the class.

The Gaba model was used as a template for the development of simulation situations, which allows to select the simulation options according to the learning objectives [8] (Table 1).

During such a class, the students worked in small groups under the supervision of the teacher, performed the necessary manipulations, sought reasoned answers to the questions posed, and explained the mechanisms of action of medicines. The students also expressed their own point of view and substantiated their choices, as well as acquired some knowledge when communicating with the classmates.

The experience has shown that the effectiveness of simulation training depends directly on the adequacy and the model relevance degree (the realistic scenario, the accuracy of reproduction of clinical features, physiological parameters, the ease of performing their roles) and the subjective perception of the situation by the participants of the simulation. Therefore, despite some difficulties at the beginning of the class (students’ shyness and uncertainty, unwillingness to the situation fully and emotionally simulate, misunderstanding of the need for such a game), the lessons were effective

Table 1. Template of the simulation situation

Aspects of simulation model	Example detalization
Topic of the simulation	Allergic reaction in the form of anaphylactic shock due to the use of antibiotics
Objective of the simulation	Preparation and clinical training
Unit of participation	Individual and team
Level of knowledge and speciality of the participants	Master's Degree (3rd year of Medical Faculty)
Medical context	Intensive care and procedures. A 28-year-old female patient is being treated at the gynecological department for acute adnexitis. She was prescribed antibiotic of cephalosporin series. A few minutes after parenteral administration of the drug, the patient's condition worsened dramatically. She complained of general weakness, tinnitus, dizziness, burning sensation throughout the body, numbness of tongue and lips, pain in the heart, coughing, nausea. She lost consciousness. Objectively: heart rate is 120 minutes, weak, heart tones are deaf. Blood pressure is sharply reduced. Breathing superficial, frequent, auscultatory wheezing
Psychomotor, affective, cognitive domains	I. Cognitive domain (decision making ability): – assessment of the general condition of the patient – severe, life threatening; – diagnosis – anaphylactic shock; – determination of patient management tactics and pharmacological treatment [1, 4]: Treatment is carried out under the control of pulse, breathing and blood pressure. 1. Introduce intramuscularly into the middle of the outer thigh 0.1 % epinephrine solution at a dose of 0.01 ml/kg body weight to a maximum total dose of 0.5 ml; 2. Put the patient so that the head is below the level of the feet, turn the head to the side, push forward the lower jaw. Provide inhalation of oxygen through a mask of 6–8 l/min. 3. Apply a bubble with ice to the injection site for 15 minutes; 4. To provide access to the vein, inject the following: – epinephrine solution (1 ml dissolved in 100 ml isotonic sodium chloride solution); – glucocorticosteroids – 3 % solution of prednisolone 2–4 mg/kg or 0.4 % solution of dexamethasone 0.3–0.6 mg/kg; – 2.4 % solution of euphilin 5 mg/kg in 20.0 ml of saline; – intravenously drip “flood the patient” with polyionic solutions – 0.9 % sodium chloride solution (500–1000 ml), 5 % glucose solution (1000–4000 ml), 5 % albumin solution (500–1000 ml). II. Psychomotor domain (technical skills) – provision of a certain position of the patient's body, administration of medicines, use of an oxygeninhalation mask, use of a hot water bottle and ice bubble. III. Affective domain – the ability to concentrate in an emergency situation, to gain confidence in their actions, the ability to work in a group
Age of the model patient	Adult
Technology used for simulation, equipment	Mannequin, student actors, medicines collection, injectables, oxygen mask, ice bubble
Venue of simulation	VNMU Simulation Center
Degree of participating	Direct participation, manual interaction, interactive participation
Feedback	Teacher's instructions at the preparatory stage and discussing and evaluating after the completion of the session using video surveillance

and useful. The students had the opportunity to feel themselves inside the situation where urgent help was needed, as minutes and even seconds of delay and confusion of the doctor were threatened with fatal consequences for the patient.

In addition to the teaching function, a simulation class allows students' knowledge to be evaluated.

During the re-briefing, not only the teachers but also the students had the opportunity to express their opinion on the success of the training. This led them not only to play their role or to watch, but also to learn how to analyze the situation, find mistakes and find ways to correct them. An important point of this methodological approach was the ability to replicate

and use students' knowledge of previous topics, which in turn is necessary to form the basis for the development of clinical thinking.

The analysis of the final results of the study showed that for disciplines such as pharmacology, which are on the verge of direct contact of the theoretical base with clinical situations, the use of imitation approach helps teachers to identify the most difficult moments for students in the study of specific topics and substantiates the need to modify the syllabuses of practical classes and lectures to improve the quality of education.

Moreover, educational simulation is an important component of preparation for the objective structured clinical exam (OSCE), which was introduced into the educational process according to the Decree of the Cabinet of Ministers of Ukraine No. 334 of March 27, 2018 [7], including the students of the third year. This exam includes a list of stations at which each student should demonstrate acquired competencies (cognitive,

communicative, manual, manipulative) in reproducing situations as close as possible to clinical, and similar to those used in model simulation training teaching.

Conclusions and Prospects for Research. 1. The organization of the educational process with the use of imitation technologies leads to the acquisition of professional practical skills at a higher level than theoretical one.

2. The maximum benefit from the use of simulation training methods is achieved during team play mostly, when a particular clinical situation is reproduced and a group of students with a distribution for each of their functions is involved in solving it.

3. Simulation training helps to bring training in theoretical departments to practical medicine, promotes the transfer of acquired competencies in real clinical activity, so its implementation and improvement is of great relevance today.

List of literature

1. Екстрена медична допомога: догоспітальний етап : Новий клінічний протокол // Наказ Міністерства охорони здоров'я України від 05.06.2019 р. № 1269. – https://moz.gov.ua/uploads/2/12737-dn_20190605_1269_dod.pdf.

2. Зайков С. В. Анафілактичний шок: діагностика, профілактика та лікування / С. В. Зайков // Клінічна імунологія. Алергологія. Інфектологія. – 2015. – № 3. – С. 31–39.

3. Льовкін О. А. Форми симуляційного навчання лікарів-слухачів, лікарів-інтернів, середнього медичного персоналу та парамедиків / О. А. Льовкін, Д. Ю. Рязанов, К. В. Серіков // Медицина невідкладних станів. – 2016. – № 5 (76). – С. 94–97.

4. Медикаментозна алергія, включаючи анафілаксію : Уніфікований клінічний протокол екстреної, первинної, вторинної (спеціалізованої) та третинної (високоспеціалізованої) медичної допомоги // Наказ Міністерства охорони здоров'я України від 30.12.2015 р. № 916. – https://dec.gov.ua/wp-content/uploads/images/dodatki/2015_916_ma/2015_916_ukpmd_ma.pdf.

5. Муравьев К. А. Симуляционное обучение в медицинском образовании – переломный момент / К. А. Муравьев, А. Б. Ходжаян, С. В. Рой // Фундаментальные исследования. – 2011. – № 10, часть 3. – С. 534–537.

6. Опыт внедрения симуляционного обучения и универсального подхода к оценке, распознаванию и

стабилизации жизнеугрожающих состояний у детей / Е. А. Старец, Н. В. Котова, Е. А. Лосева, О. В. Федоренко // Клінічна анестезіологія та інтенсивна терапія. – 2018. – № 1 (11). – С. 93–102.

7. Про затвердження порядку здійснення єдиного державного кваліфікаційного іспиту для здобувачів ступеня вищої освіти магістр за спеціальностями галузі знань 22 «Охорона здоров'я» : Постанова Кабінету Міністрів України від 28.03.2018 р. № 334. – <https://zakon.rada.gov.ua/laws/show/334-2018-%D0%BF>.

8. Симуляції в системі медичного образования. Создание программы симуляционного обучения / Камран Кан, Серена Толхюрст-Кливер, Сара Уайт, Уильям Симпсон // Медицинское образование и профессиональное развитие. – 2011. – № 3 (5). – С. 26–65.

9. Симуляційне навчання у медицині – складова частина у процесі підготовки лікаря-спеціаліста / М. М. Корда, А. Г. Шульгай, С. Й. Запорожан, М. Ю. Крицак // Медична освіта. – 2016. – № 4. – С. 17–20.

10. Симуляційні технології у навчанні сімейних лікарів / В. М. Ждан, М. Ю. Бабаніна, Є. М. Кітура [та ін.] // Сімейна медицина. – 2019. – № 4 (84). – С. 94–96.

11. Тутченко М. І. Симуляційні технології в навчанні студентів-медиків практичним навичкам / М. І. Тутченко, Я. М. Сусак // Вісник ВДНЗУ «Українська медична стоматологічна академія». – 2013. – Т. 13, № 1 (41). – С. 326–327.

References

1. Ekstrena medychna dopomoha: dohospitalnyi etap. Novyi klinichniy protokol [Emergency medical care: pre-hospital stage. New Clinical Protocol]. *Nakaz Ministerstva okhorony zdorovia Ukrainy – Order of the Ministry of Health of Ukraine*, June 05, 2019, No. 1269. Retrieved from: [https://](https://moz.gov.ua/uploads/2/12737-dn_20190605_1269_dod.pdf)

moz.gov.ua/uploads/2/12737-dn_20190605_1269_dod.pdf [in Ukrainian].

2. Zaikov, S.V. (2015). Anafilaktychnyi shok: diahnostryka, profilyaktyka ta likuvannia [Anaphylactic shock: diagnosis, prevention and treatment]. *Klinichna imunolohiia. Aler-*

holohiia. *Infektolohiia – Clinical Immunology. Allergology. Infectology*, 3, 31-39 [in Ukrainian].

3. Lovkin, O.A., Riazanov, D.Yu., & Serikov, K.V. (2016). Formy symuliatyinoho navchannia likariv-slukhachiv, likariv-interniv, serednoho medychnoho personalu ta paramedykiv [Forms of simulation training for trainees, interns, nursing staff, and paramedics]. *Medytsyna nevidkladnykh staniv – Emergency Medicine*, 5 (76), 94-97 [in Ukrainian].

4. Unifikovanyi klinichniy protokol ekstretoi, pervynnoi, vtoryynnoi (spetsializovanoi) ta tretynnoi (vysokospetsializovanoi) medychnoi dopomohy. Medykamentozna alerhiia, vkluchaiuchy anafilaksiu [Unified clinical protocol for emergency, primary, secondary (specialized) and tertiary (highly specialized) medical care. Drug allergy, including anaphylaxis]. *Nakaz Ministerstva okhorony zdorovia Ukrainy – Order of the Ministry of Health of Ukraine*, December 30, 2015, No. 916. Retrieved from: https://dec.gov.ua/wp-content/uploads/images/dodatki/2015_916_ma/2015_916_ykpm_d_ma.pdf [in Ukrainian].

5. Muravev, K.A., Khodzhan, A.B., & Roy, S.V. (2011). Simulyatsionnoe obuchenie v meditsynskom obrazovanii – perelomnyy moment [Simulation training in medical education is a turning point]. *Fundamentalnye issledovaniya – Fundamental Research*, 10 (3), 534-537 [in Russian].

6. Starets, Ye.A., Kotova, N.V., Loseva, Ye.A., & Fedorenko, O.V. (2018). Opyt vnedreniya simulyatsionnogo obucheniya i universalnogo podkhoda k otsenke, raspoznavaniyu i stabilizatsii zhizneugrozhayushchikh sostoyaniy u detey [The experience of implementing simulation training and a universal approach to the assessment, recognition and stabilization of life-threatening conditions in children]. *Clinichna anesteziolohiia ta intensyvna terapiia – Clinical Anesthesiology & Intensive Care*, 1 (11), 93-102 [in Ukrainian].

7. Pro zatverdzhennia poriadku zdiisnennia yedynoho derzhavnogo kvalifikatsiynoho ispytu dlia zdobuvachiv stupenia vyshchoi osvity mahistr za spetsialnostiamy haluzi znan “22 Okhorona zdorovia” [On Approval of the Procedure of Implementation of the Unified State Qualification Exam for Higher Education Applicants Master’s Degree in the Specialties of the Knowledge of 22 Health Care]. *Postanova Kabinetu ministriv Ukrainy – Resolution of the Cabinet of Ministers of Ukraine*, March 28, 2018, No. 334 [in Ukrainian].

8. Kamran Kan, Serena Tolkhyurst-Kliver, Sara Uayt, & Uilyam Simpson (2011). Simulyatsii v sisteme meditsynskogo obrazovaniya. Sozdanie programmy simulyatsionnogo obucheniya [Simulations in the medical education system. Creating a Simulation Training Program]. *Meditsynskoe obrazovanie i professionalnoe razvitie – Medical Education and Professional Development*, (5), 26-65 [in Russian].

9. Korda, M.M., Shulhai, A.H., Zaporozhan, S.Y., & Kritsak, M.Yu. (2016). Symuliatyine navchannia u medytsyni – skladova chastyna u protsesi pidhotovky likaria-spetsialista [Simulation training in medicine – an integral part in the preparation of a specialist doctor]. *Medychna osvita – Medical Education*, 4, 17-20 [in Ukrainian].

10. Zhdan, V.M., Babanina, M.Yu., Kitura, Ye.M., Tkachenko, M.V., Shylkina, L.M., & Kyrian, O.A. (2019). Symuliatyini tekhnolohii u navchanni simeinykh likariv [Simulation technologies in teaching family doctors]. *Simeina medytsyna – Family Medicine*, 4 (84), 94-96 [in Ukrainian].

11. Tutchenko, M.I., & Susak, Ya.M. (2013). Symuliatyini tekhnolohii v navchanni studentiv-medykiv praktychnym navychkam [Simulation technologies in teaching medical students practical skills]. *Visnyk VDNZU “Ukrainska medychna stomatolohichna akademiia” – Bulletin of VDNZU “Ukrainian Medical Dental Academy”*, 1 (41), 326-327 [in Ukrainian].

Received 04.06.20
Recommended 08.06.20

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