



# SIMULATION-BASED TRAINING OF REGIONAL ANESTHESIA MEDICAL SIMULATION CENTER, UNIVERSITY MEDICAL CENTER LJUBLJANA, SLOVENIA

Vesna Novak - Jankovič

Head  
Medical Simulation Center  
University Medical Center Ljubljana

**ABSTRACT** – Simulation-based training is a technique, which uses technological devices to reproduce different clinical situations like in the real world. Procedures and simulation scenarios performed on simulators can be planned and repeated with no harm for the patient. Simulation-based training introduced new educational applications in medicine to improve patient safety. Simulation education was introduced in the anesthesia curriculum in 2017 as a first specialization in Slovenia.

**Key words:** *simulation-based training, regional anesthesia, simulation center*

## Introduction

Simulation-based training is a technique, not a technology for replacing or amplifying real experiences with guided ones that evoke aspects of the real world in a fully interactive way (1).

Simulation represents techniques which can use different technological devices such as part-task trainers, simple simulators using fruit, ultrasound imaging, high-tech computer controlled mannequin, and in the novel times virtual or augmented reality.

Simulator is defined as a device that enables the instructor to reproduce under test conditions phenomena likely to occur in actual performance.

Over the last decades, health care has been characterized by huge development in technology, diagnosis, treatment, pharmacology but despite this, many medical errors still occur.

According to the World Health Organization 10% of patients in high-income countries are harmed in hospitals, with 50% of adverse events being preventable. Adverse events are responsible for 15% of total expenses in hospitals.

In 2016, an alarming article was published which showed that medical error is the third leading cause of death in the United States (2).

Concerns about patient safety have led to the development of simulation techniques and simulation centers in medical education.

## Simulation training

Simulation-based training (crew resource management) itself is not new. It has been widely applied in the aviation, military and space industry.

The history of simulation learning is rich. In the Middle Ages, warriors were trained by quintain, which simulated a combat situation.

In 1930, the flight simulator was designed for flight training.

In 1984, The Anesthesia Patient Safety Foundation was founded to ensure that no patient is harmed by

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Address for correspondence:

*Prof. Vesna Novak – Jankovič MD, PhD*

Head

Medical Simulation Center, University Medical Center Ljubljana  
Zaloška 7, 1000 Ljubljana, Slovenia  
e.mail: vnovakjankovic@gmail.com

anesthesia and they provided funding for earlier work anesthesia simulation (3).

The increase in technological progress gives the opportunity to develop more and more sophisticated simulators.

Training with simulation does no harm to patients, errors can be allowed to occur and can even be planned.

Simulation-based training enhances efficiency of the learning process in controlled and safe conditions.

The skills, which can be trained with the use of simulation techniques, include technical skills problem solving and decision-making thinking or interpersonal, communication skills and team based competencies.

Specialization is a learning and educational process, where a medical trainee obtains theoretical and practical skills in the area of anesthesiology, reanimatology, perioperative intensive care medicine, acute and chronic pain management.

It has been demonstrated that trainees who have experienced using task training devices, which effectively simulate the psychomotor skills needed for procedures, will accomplish the task in a clinical practice more rapidly and with fewer errors than their inexperienced colleagues (4). That was one of the reasons why we in Slovenia introduced simulation teaching in anesthesia curriculum. Anesthesiology is the first medical specialty in our country with simulation education since the year 2017.

The specialization of Anesthesiology, reanimatology and perioperative intensive medicine in Slovenia lasts six years. We have introduced modular education, two times per year spring and autumn module, totaling twelve modules in which all syllabus and curriculum are included according to the European training requirements. Trainees are spending their time during modular education in the Medical simulation centers (MSC) of University Medical Center Ljubljana (UMCL) and University Medical Center Maribor. In 2021, MSC UMCL celebrated the tenth anniversary of its operation (5).

The knowledge acquisition in MSC of our anesthesia trainees is facilitated by lectures, skillfulness by practicing specific maneuvers and procedures using different part-task trainers and full-scale simulation using high-fidelity patient simulators specifically designed for training in anesthesia and intensive care medicine. Lately we introduced virtual reality simulation teaching. Simulation training is organized with a progressive increase of difficulty. During the first visit to the MSC, novices get familiar with anesthesia in a highly realistic operating theater. They learn and practice how to use an anesthesia machine, different monitors, perfusers, ultrasound devices etc.

In such a safe environment, the trainees can practice not only the management of different clinical scenarios, but also their nontechnical skills—communication, leadership and cooperation. The scenario is audio-video recorded and this recording is used for debriefing to analyze the strengths and weaknesses of the treatment provided. The instructor acts as a facilitator of learning and helps the trainees to reflect on their own practice.

Altogether 275 residents evaluated module-training program (table 1)

During the anesthesia residency, program simulation is not only used as a training method but also as the method for competence assessment of anesthesia trainees.

Our anesthesia trainees have the opportunity to practice psychomotor skills, full-skill simulation and non-technical skills in a safe environment and without the risk of harming the patients.

Regional anesthesia inherently requires precise procedural performance due to target nerve locations near vital structures (e.g., blood vessels, pleura, organs, and nerves themselves) and seems naturally suited for the incorporation of simulation within the training curricula. Further, the recent evolution of ultrasound guidance in the practice of regional anesthesia has created great demand for training in this imaging modality. The American Society of Regional Anesthesia and Pain Medicine (ASRA) and the Europe-

*Table 1 Average evaluations of delivered modules*

Satisfaction with content	Satisfaction with organization	Lecturer-presenting information	Material	Received enough information(%)	Informations will make work easier (%)	General satisfaction
4,74	4,81	4,92	4,16	83	79	4,8

Marks are presented as mean value; range (1-5)

an Society of Regional Anesthesia and Pain Therapy (ESRA) have published joint committee guidelines for training in ultrasound-guided regional anesthesia, and the ASRA–ESRA guidelines suggest that simulation plays an important role (6).

Our curriculum is harmonized with these guidelines (Table 2).

Table 2 Module 5 of regional anaesthesia

Module 5	Regional anaesthesia
	Pharmacology of local anaesthetics
	Central nerve blocks
	Peripheral nerve blocks
	Ultrasound-guided regional anaesthesia
	Workshop on cadavers
	Virtual reality

In 2015, during ESRA congress in Ljubljana a workshop of regional anesthesia was performed in MSC UMCL (fig. 1).



Figure 1 Simulation workshop in Medical Simulation Center, University Medical Center Ljubljana (MSC UMCL) during ESRA congress in Ljubljana in 2015

Learning and achieving expertise in ultrasound-guided regional anesthesia (UGRA) is challenging and rather extensive. To perform UGRA blocks successfully, a triad of skills is important: image acquisition, anatomic interpretation and hand-eye coordination. (7). Learning procedures on models in simulation centers is imperative in training to

become an independent UGRA practitioner. UGRA simulations offer the opportunity to shorten learning curves and consequently result in a higher rate of successful blocks (fig. 2, fig. 3).



Figure 2 The blue phantoms are useful in the training of needle guidance in MSC UMCL



Figure 3 Training of ultrasound guided regional anaesthesia on the phantom in MSC UMCL

Epidural and spinal anesthesia simulators consist of a torso with a synthetic spinal column that includes a ligamentum flavum and a spinal cord within a fluid-filled thecal sac. These trainers can reasonably recreate the touch, feel and consistency of a normal human back and the structures involved in neuraxial regional techniques (fig.4).

Although in MSC complex epidural simulators are used, banana fruit is a cheap and easily available train-



Figure 4 Training of epidural block on the part task trainer in MSC UMCL

ing tool to introduce novices to the feel of loss of resistance before the first insertion of an epidural catheter to the patient (fig. 5) (8).



Fig 5 Banana a simple epidural space simulator (MSC UMCL)

Our trainees have the opportunity to train the regional anesthesia not only by using part-task trainer; they can train management of critical events associated with regional anesthesia with high-tech computer-controlled manikin such as METI's Human Patient Simulator (fig. 6).

We are implementing a new form of simulation-based education in MSC by using technology that enables display of virtual reality. This simulation method has proven to be very successful in learning



Figure 6 Training on METI's Human Patient Simulator in MSC UMCL

to communicate, make decisions and lead a team. With this technique, we can show various patients and clinical situations. Virtual reality learning, however, does not allow for manual skill practice. However, it makes it easier to understand the three-dimensional anatomy for performing various blocks (fig. 7) (9)

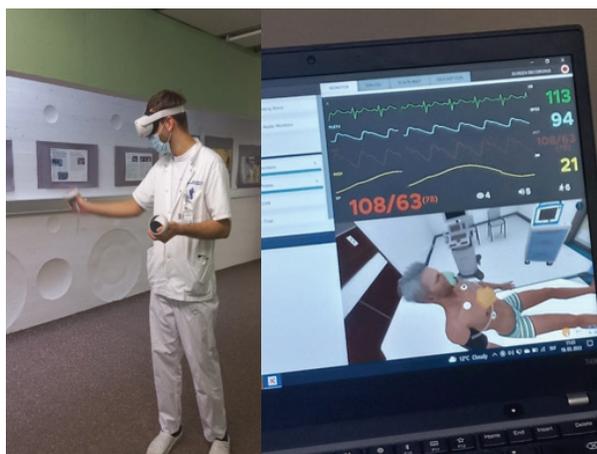


Figure 7 Training with Virtual Reality in MSC UMCL

The learning process is very complex. Debriefing and feedback have been identified as the most important aspects of simulation-based learning. Debriefing is the part of the process where most of the learning takes place. Different debriefing techniques are used and mentors should be familiar with them (fig. 8) (10).



Figure 8 Debriefing in MSC UMCL

## Conclusion

Simulation will never replace reality. Simulation based clinical training is a supplement, not a replacement for traditional training and maintenance of competence.

Simulation-based learning can prepare trainees on training on patients to improve patient safety. Simulation based education is an investment that pays off in the long run. Trainees who have undergone simulation based learning have greater self-confidence when confronted with situations in clinical practice; resolve them more quickly, are less likely to have treatment complications, and thus improve patient safety

The current generation of leaders in health care and in medical simulation will be the key players in deter-

mining which direction in the future simulation-based training will develop.

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## Sažetak

### EDUKACIJA TEMELJENA NA SIMULACIJAMA REGIONALNE ANESTEZIJE U MEDICINSKOM SIMULACIJSKOM CENTRU, SVEUČILIŠNI MEDICINSKI CENTAR LJUBLJANA, SLOVENIJA

V. Novak - Jankovič

Simulacijska edukacija je tehnika koja koristi tehnološku opremu da ustvari različite kliničke situacije kao u stvarnim kliničnim uvjetima. Zahvati i različiti scenariji izvedeni na simulatorima se mogu planirati i ponavljati bez opasnosti za pacijenta. Simulacijsko učenje uvodi nove edukacijske metode u medicinu kako bi se unaprijedila sigurnost u tretmanu pacijenata. U slovenski kurikulum specijalizacije iz Anesteziologije, reanimatologije i perioperativne intenzivne medicine je simulacijsko učenje uvedeno godine 2017 kao prvo u Sloveniji.

Ključne riječi: *simulacijska edukacija, regionalna anestezija, simulacijski centar*