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Importance of simulation-based medical education and its application in diabetology

Znaczenie symulacji medycznej w edukacji i jej zastosowanie w diabetologii

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Introduction

The rapid development of new technologies in the medical industry is causing a growing demand for up-to-date methods of learning, based on gaining both theoretical and practical knowledge. Exposing patients to inexperienced healthcare practitioners, can be a cause of unnecessary medical errors. In 2021, 5,206 medical malpractice cases were handled by prosecutors in Poland, and in 2018–2020 it was, in order: 5,739, 5,905, and 5,464 cases [1]. Simulation-based learning (SBL) as one of the newer learning methods is increasingly being used in transforming medical education [2]. The SBL has been proven to be a superior learning method compared to both lecture-based learning and problem-based learning [3, 4]. Simulation "is the artificial representation of a complex real-world process with sufficient fidelity with the aim to facilitate learning through immersion, reflection, feedback, and practice minus the risks inherent in a similar real-life experience" [5]. Simulation can be used in many forms, including virtual patients [2], simulation via instant messaging [6], static and interactive manikin simulators, computer simulations, and serious games [7]. The versatility of SBL lies in the fact that it can be used at every level of medical training, from learning simple technical skills as a trainee, to whole procedure simulations for professionals, to help them reinforce teamwork and communication skills [8]. Simulation-based medical education has been widely used across disciplines in medicine [6], but in the further part of this review we will try to focus on its application in diabetology.

Aim of the study

The aim of the paper is to explain why simulation-based learning is the future of medical education. The other objective is to acquaint readers with the wide spectrum of SBL forms and applications, with particular reference to diabetology.

The efficacy of simulation as a training methodology

Before we delve into the topic of application of SBL in diabetology, we would like to explain why the interest in this method of learning in medical education is growing.

Benefits of simulation-based learning

Simulation has a wide range of uses in education of healthcare practitioners, and it has proven effective in transferring knowledge to both trainees and practicing health professionals [8]. SBL enables the presentation of scenarios that are common in healthcare as well as rare events that are usually not encountered during training. The acquisition of new skills by medical personnel and the improvement of old ones take place in a safe and controlled environment, which provides an opportunity to make mistakes and learn from them without harming the patient.

Learners can repeat a given scenario many times, which allows them to experience the consequences of different choices and find the best solution to a problem [9, 10]. Other SBL benefits worth mentioning include the following: the research is not dependent on a specific set of patients being available, simulated environments are easier to standardise than actual clinical environments, there are no concerns related to protected health information and multiple options for outcome measures: data can be collected from the subjects, extracted from the simulator, or captured by video/audio [11].

Scope of simulation in healthcare

Simulation-based education can be useful in a broad range of medical fields. Deering *et al.* [12] described how training with

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a simulation scenario improved residents' performance in the management of shoulder dystocia – an example of SBL application in Obstetrics and Gynaecology. Pezel *et al.* [13] reported how Cardiology is ideal for simulation in terms of technical procedures, communication skills, and team management. In Pulmonology, SBL has been used in bronchoscopy training, which was described by Kennedy *et al.* [14]. Eroglu and Coskun [15] reported how medical students can learn to use an ultrasound device within a short period of time via simulation-based training programs, and in a recent study Gaubert *et al.* [16] described how students' theoretical knowledge and level of self-confidence showed a significant improvement after lumbar puncture simulation training.

Application of Simulation-Based Medical Education in Diabetology

In recent years, the incidence of diabetes, as well as its complications and comorbidities, has increased dramatically [17]. More than half of diabetics have hypertension, dyslipidaemia, or obesity [18]. As proven in research, the health-related quality of life of patients with diabetes is significantly lower than that of the general population [19]. All this means that more progress needs to be made in the diagnosis and treatment of diabetes. Therefore, more attention should be paid to the importance of wide multidisciplinary team education in the care of patients with diabetes. Let us move on to examples of how the use of SBL can contribute to increasing the level of education of healthcare professionals in the field of diabetology.

The Role of Virtual Reality in Simulation

The pilot project, titled 'DEVICE' (Diabetes Emergencies: Virtual Interactive Clinical Education), was developed by Mallik *et al.*[2] in collaboration with Oxford Medical Simulation. As we can learn from the research "Exploring the Role of Virtual Reality to Support Clinical Diabetes Training – A Pilot Study", virtual reality (VR)-based educational resources are changing medical education. The aim of this project was to help non-specialist clinicians manage clinical scenarios related to diabetes. Thirty-nine trainees took part in fully interactive VR simulation and provided feedback before and after the participation in the scenario. The simulation not only had a positive impact on learning, but also allowed trainees to improve their skills in managing diabetes emergencies like diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS).

The Use of a Virtual Model to Teach Diabetes Care Management

In a research paper titled "Using Simulation Technology to Teach Diabetes Care Management Skills to Resident Physicians", Sperl-Hillen *et al.* [20] described the development and implementation of an innovative virtual model created with the aim of educating residents about diabetes care management. The virtual model was based on 18 virtual cases (which covered basic, intermediate, and advanced learning topics), a web-based interactive interface, a simulation model designed to show residents the outcomes of their actions, and at the case conclusion – feedback from the expert.

The learners received new cases each month for 6 months, with time for appropriate case study. Residents were able to repeat each case to solve possible clinical management errors and achieve mastery. The virtual model was well-liked by primary care residents and received comments such as "fabulous learning tool". The study was successfully completed and obtained high scores in terms of satisfaction, and showed positive changes in self-assessment knowledge, self-confidence, and practice patterns.

Simulation via Instant Messaging

Melson *et al.* [6] developed a social media/computer-based simulation called SIMBA. The research article titled "Simulation via instant messaging-Birmingham advance (SIMBA) model helped improve clinicians' confidence to manage cases in diabetes and endocrinology" describes the use of an instant messaging platform (WhatsApp®) as an educational tool. The goal of this study was to create a simple virtual learning environment for clinicians. The simulation was based on real-life scenarios with no patient-identifiable data. Anonymised transcripts were created and approved by a consultant with specialist expertise. These transcripts included medical history, clinical examinations, investigation results, imaging, and other relevant information. The moderators, whose role was to simulate the patient, were familiarised with the transcript 3 weeks before the session. Clinicians were provided with pre-simulation instructions and were instructed to approach the moderator as a regular patient. The simulation was based on providing the information needed for diagnosis by the moderator; if a trainee requested physical, biochemical, or radiological examinations, the moderator simulated a senior clinician to provide this information. After the session the trainees were informed about the accuracy of their diagnosis and were asked to reflect on their performance. SIMBA was found to be practical and relevant by learners, and overall there was a significant improvement in the trainees' confidence in managing cases in diabetes and endocrinology.

Conclusion

In conclusion, simulation-based learning is a well-liked and useful tool essential in the future education of both trainees and practicing health professionals. In the face of rapidly developing medical technology, SBL helps to provide both theoretical and practical knowledge. Although simulation has been proven to be effective in diabetes care, there is still a need for further analysis of its use and expanding its application.

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