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Simulation for education, training, and research*Abstract:*

Simulation verbreitet sich zunehmend international und stellt einen sicheren Rahmen für das Üben unsicherer Handlungen zur Verfügung. Es stehen unterschiedliche Simulationsverfahren zur Verfügung, die sich für unterschiedliche Zwecke nutzen lassen. Bildschirmbasierte Simulatoren, mit denen sich physiologische Zusammenhänge aber auch Abläufe erlernen lassen, bis hin zu Patientensimulatoren, an denen das komplexe Zusammenspiel von Mensch, Technik und Organisation analysiert und optimiert werden kann. Sowohl in Simulationszentren als auch mobil werden mit diesen lebensgroßen, computerisierten Puppen Trainings angeboten. In Szenarien können die Teilnehmer herausfordernde Situationen bearbeiten, die sie dann gemeinsam mit den Instrukto-ren in sog. Debriefings analysieren. Um die Szenarien und Debriefings angemessen durchführen zu können, benötigen die Instrukto-ren ausreichende Kompetenzen. Sie müssen den Teilnehmern die Möglichkeiten und Grenzen der Simulation klar machen, Szenarien entwickeln und durchführen, sowie die Nachbesprechungen leiten. Hierzu gibt es mittlerweile einige Zentren, die Instrukto-renkurse anbieten, z.B. in Kooperation zwischen den Simulationszentren in Kopenhagen (DK), Tübingen (D) und London (UK). Neben dem Training bietet es sich auch an Simulatoren zu nutzen um mehr über potentielle Gefährdungen der Patientensicherheit zu erfahren und Fehlleistungen genauer zu untersuchen. Besonders, wenn Simulationen auf Grundlage von Daten aus Incident-Reporting Systemen aufbauen, können sie dazu beitragen,

relevante Trainings durchzuführen. Falls Sie mehr über Simulation wissen wollen haben wir einige Links für Sie zusammengestellt, beantworten aber auch gerne direkte Anfragen.

The idea and methodology of simulation is spreading throughout medicine and around the world for basic education of students, post-graduate training as well as research. Different simulative techniques are available and can be used with different purposes. Screen-based simulators allow for learning about basic physiological facts but also to practice procedural approaches to specific clinical situations (e.g. practicing resuscitation guidelines). So called part-task trainers (e.g. intubation heads, infusion arms) allow students to acquire, maintain, and refine psychomotor skills. There are also simulators to learn and practice advanced surgical skills. In this paper we will focus on manikin-based patient simulators – but first we provide the reasons for doing so.

Patient safety as background for using manikin-based simulators

It is estimated that in up to 70% of incidents and accidents in medicine, “human factors” are involved as primary root causes or contributing factors; nevertheless human factors are only touched upon throughout basic and advanced medical education. The principles of Crisis Resource Management (CRM) provide a framework that helps in preventing and managing such difficult clinical situations by optimising individual aspects (e.g. decision making, attention control) and team work issues (e.g. communication, leadership and follower ship)¹. CRM helps to strengthen the positive aspects of “human factors” in the management of difficult situations: the recognition of problems and the prevention of further negative consequences. Manikin-based simulations are well-suited to helping participants recognise the importance of CRM and to learn how to use those principles during clinical practice.

Simulation-based training

Simulation-based courses focus on technical skills (e.g. handling difficult airway situations), CRM-related skills (e.g. managing complex clinical situations) or a mixture of both. The target groups range from students (e.g. medical, nursing, paramedics) to experienced health care professionals of the different professions. There are courses available for whole teams and “open” courses in which participants from different organisations take part. Depending on content and target groups, simulation-based courses last between a few hours and 2 days. The courses are run in simulation centres, as well as in actual health care settings.

The simulator manikins that are used during such courses are life-sized, computerised and available resembling patients of different ages (i.e. adult, child, baby). They can be treated in a similar way to an actual patient and realistically present a wealth of vital signs which react to treatment. The manikin is set-up in an area that resembles health care settings in which the course participants work (e.g. operating room, intensive care unit, ambulance car)².

Simulation scenarios involve emergencies, complications, or incidents and last between 10 - 30 minutes. The course participants (as well as role players) actively treat the simulated patient using actual medical equipment, drugs etc. Ideally audio and/or video recordings are additionally used to enable participants to take a different perspective on their own actions during the moderated discussion after the scenario – the debriefing³.

The thorough and analytical debriefing is a key feature of simulation-based learning that also differentiates it from many traditional teaching methods in medicine – especially when the CRM principles are discussed. Debriefings often have three phases⁴. In the *description phase* a common understanding of the preceding scenario is established. During the *analysis phase* instructors and participants discuss what goals the participants wanted to reach and which

steps they took to do so. In an interactive discussion the steps are evaluated in terms of how suitable they were to reach the desired goals⁵. In the *application phase* participants analyse how they can apply in their clinical settings what they learned during the simulation. Throughout a training course participants have the opportunity to gain experience with a selection of cases and, more importantly, reflect on principles that can help them to manage a whole variety of cases better⁶. Training with simulation ideally means more than just practicing on specific cases. It should allow participants to reflect upon their actions on a broader basis. Thus simulation-based courses provide a safe environment in which participants can practice possibly risky actions as no physical harm can be done a patient and they also get feedback which is difficult to obtain during clinical practice.

The concept of “in-Situ” simulation with mobile simulation equipment

Bringing the simulator to participants, instead of participants to the simulator has many, not only logistical advantages. With mobile “in-situ” courses those participants who normally work together can also train together and importantly, participants can also train where they work. During “in-situ” courses, training and organisational change merge. Mobile courses allow for testing the system of care, which involves technology and the “organisation” itself as well as the health care professionals. Working through emergency scenarios can focus the attention on equipment that is missing, broken or ill-suited for the tasks for which it should be used⁷.

Instructor courses

Using simulation for a relevant educational endeavour requires the instructors themselves to be highly competent too. They need to be able to explain the benefits and boundaries of simulation to course participants, design and run appropriate simulation scenarios, and facilitate discussions during debriefing. Those different tasks are related to different roles that instructors take on throughout a typical “simulator setting”. In general their role is to facilitate the learning of participants – which requires different skills than more traditional teaching methods like lecturing. It is important that instructors can create a safe learning environment and take the different influencing factors into account that can “make or break” a simulation-based course (e.g. the learning atmosphere). Many simulation centres have realised the importance of these issues and have developed courses where health care professionals can train for those different roles⁸. One such course is conducted in a multi-centre initiative between the simulation centres in Copenhagen (Denmark), Tuebingen (Germany) and London (UK). The benefit of such a multi-centre course lies in the wealth of perspectives it can offer. All course educators promote the same core issues but from their own individual and centre-based perspective. Participants and instructors rotate in order to maximize the possibilities to experience different approaches, thus preparing participants for a variety of different uses of simulation.

Using simulation for research about human factors

It is still not common in medicine to discuss errors (or good solutions) openly, which means that knowledge of causes and contributing factors is limited. Simulation can play a major role in improving our understanding of errors, their development, and ways to address them⁹. The debriefing structure can be used as a methodological frame for such discussions, so that simulation and debriefing can help to establish a culture of safety by improving communication. Basing simulations on reports from incident reporting systems makes it

possible to design highly relevant simulation scenarios for training or to further analyse a specific report and to prepare participants to handle it optimally. Like simulation, incident reporting systems are also spreading around the world¹⁰.

Conclusion

Simulation offers many avenues to increase patient safety. It can be used during the training of participants in CRM both in simulation centres and “in-situ”. For the optimal use of simulation as a useful tool, the instructors need appropriate training in instructor courses. Simulators will also play an increasing role in research about human factors which is required to assess the needs to further refine simulation-based training.

Further information

For further information or to find the nearest simulation centre, please contact the established simulation societies: The Society in Europe for Simulation Applied to Medicine (SESAM – www.sesam.ws) or the Society for Simulation in Health Care (SSH – www.ssih.org). We are also happy to answer questions and provide more information.

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