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Featured Article

Learning High-Energy Trauma Care Through Simulation

Anna Abelsson, PhD[a],*, Ingrid Rystedt, MD, PhD[a], Björn-Ove Suserud, PhD[b], Lillemor Lindwall, PhD[c]

[a]Associate Professor, Department of Health Sciences, Karlstad University, Karlstad, Sweden
[b]Professor, Faculty of Caring Science, Work Life and Social Welfare, PreHospen - Centre for prehospital Research, University of Borås, Borås, Sweden
[c]Professor, Department of Health Sciences, Karlstad University, Karlstad, Sweden

Abstract: Simulation provides the opportunity to learn how to care for patients in complex situations, such as when patients are exposed to high-energy trauma such as motor vehicle accidents. The aim of the study was to describe nurses' perceptions of high-energy trauma care through simulation in prehospital emergency care. The study had a qualitative design. Interviews were conducted with 20 nurses after performing a simulated training series. Data were analyzed using a phenomenographic method. The result indicates that simulation establishes, corrects, and confirms knowledge and skills related to trauma care in prehospital emergency settings. Trauma knowledge is readily available in memory and can be quickly retrieved in a future trauma situation.

Cite this article:

This study highlights nurses' perceptions of high-energy trauma care through simulation in prehospital emergency care at an ambulance station. High-energy trauma is defined as open or closed injuries caused by forces such as motor accidents or falls from heights, inducing extensive damage by transferring a high amount of kinetic energy to the tissue. Trauma care is time sensitive depending on the often complex condition of the patient. As such, it demands well-educated and trained nurses. It requires the ambulance staff to have theoretical knowledge and practical clinical experience (Colleague of Paramedics, 2015). To increase the level of patient safety in the prehospital emergency care, there is a need for formalized training (Suserud & Haljamäe, 1999). This could be done through simulation.

Background

Patients exposed to high-energy trauma are relatively uncommon in Sweden (Suserud, Bruce, & Dahlberg, 2003a). High-energy trauma care in the ambulance is, according to nurses in prehospital emergency care, performed on average six times a year (Abelsson & Lindwall, 2012). This low frequency means that the nurses may have difficulty obtaining and maintaining adequate experience in all kinds of traumas. At the same time, Swetrau (2015) points out that appropriate and up-to-date skills and knowledge of trauma care are crucial for patient safety.

In prehospital emergency care of patients, the caring relationship is a prerequisite for the nurse to perceive the patient as a human being and not focusing solely on the injury (Arman, Dahlgren, & Ekebergh, 2015). Assessment and care are therefore always founded on a balance between medicine and care (Suserud, Dahlberg, & Dahlberg, 2003b). In Swedish prehospital emergency care, there are three separate professions: basic emergency medical technicians, registered nurses with a three-year bachelor degree at the university level, and specialist ambulance nurses with one-year additional prehospital specialist education. In addition, specialist intensive care nurses and anesthesia nurses may work in the ambulances. A physician may be available to assist in larger cities. In this study, all nurses working in the ambulance are referred to as nurses in prehospital emergency care.

The experienced nurses in prehospital emergency care possess an understanding of an overall pattern across trauma situations. The experienced nurse will be able to quickly create a complete picture of the scene of an accident (Benner, 2001). Experienced nurses, therefore, have the ability to adjust their behavior according to the situation. The prerequisite for inexperienced nurses in prehospital emergency care to perform high-quality trauma care will not be the same as for the experienced nurses.

Knowledge acquisitions for nurse students are, according to Lapkin, Levett-Jones, Bellchambers, and Fernandez (2010), improved by simulation. Through simulation, a theoretical knowledge can be obtained and maintained while, at the same time, clinical skills are acquired and practiced (Lapkin et al., 2010). Earlier studies show that simulations are successfully used when training in how to manage a complex situation, such as caring for trauma patients (Garvey, Liddil, Eley, & Winfield, 2016; Hagiwara, Kängström, Jonsson, & Lundberg, 2014; Johnson, Ramos-Alarilla, Harilal, Case, & Dillon, 2012). One way for nurses in prehospital emergency care to learn trauma care is to use simulation conducted at ambulance stations. The aim of the study was to describe nurses in prehospital emergency care perceptions of learning high-energy trauma care through simulation.

Methods

The study had a qualitative design. The method used was phenomenography, which describes peoples' conceptions of the specific phenomenon as opposed to describing the phenomenon in itself (Marton, 1981, 1986). Phenomenography distinguishes between the first-order perspective "What" explaining the different phenomena and the second-order perspective "How" describing people's various conceptions of a phenomenon (Marton, 1981). The area of knowledge and the phenomenon under study were the nurses' perception of prehospital emergency care in learning high-energy trauma care through simulation.

Participants

The sample consisted of 20 nurses in prehospital emergency care in two counties in central Sweden (Table). The inclusion criteria were nurses in prehospital emergency care who had participated in an intervention consisting of series of four sessions of trauma simulation during a six-month period. They were all asked to participate in the study during the first simulation and again after the fourth simulation when the interviews took place. All nurses accepted to participate and had previous simulation experience. The participants were in no way dependent on the researcher and were informed of the aim of the research.

Setting

A simulation model according to Dieckmann (2009) was used consisting of the seven steps; setting introduction, simulation briefing, theory input, scenario briefing, scenario, debriefing, and ending (Figure 1).

The scenarios were simulated by the participants in pairs. The trauma care was based on the Prehospital Trauma Life Support (2014) (PHTLS®) mnemonic concept *Airway, Breathing, Circulation, Disability, and Exposure* (ABCDE), used in the clinical prehospital setting in Sweden. The team received an emergency call regarding the current scenario and was informed about the fictional driving time to the patient. A bystander or relative, impersonated by the facilitator, met up at the scene of the accident, and the participants were shown a picture of the accident site. The patient was represented by a Resusci Anne Basic

Key Points
- Simulation establishes, corrects, and confirms knowledge and skills related to trauma care in prehospital emergency settings.
- Simulation reinforces a systematic approach to assessment and care and provides insight into alternative care actions.
- Simulation and debriefing ensure that trauma knowledge is readily available in memory and can be quickly retrieved in a future trauma situation.

Table Demographics of the Participants	
Demographic Items	Background Characteristics of the Participants
Age	25-52 years (mean, 34; median, 34)
Gender	6 women (30%) and 14 men (70%)
Work experience in hospital-based emergency care	0-23 years (mean, 5; median, 5)
Work experience from emergency medical services	1-11 years (mean, 6; median, 4)
Education level	2 registered nurses (10%)
	18 nurses with specialist degree, 17 specialist ambulance nurses (85%), and 1 specialist anesthesia nurse (5%)

(Laerdal®, Stavanger, Norway) that was moulaged with current injuries. The facilitator gave vital parameters during the scenario.

Data Collection

The first author, also the facilitator, with prior experience in interviewing, conducted the interviews at the end of fourth simulation session. The interviews were conducted during working hours with two participants at a time at the participants' ambulance station. No other persons were present during the simulation or the interviews. All interviews started with an open-ended question: *Would you describe your perceptions of learning high-energy trauma care through simulation?* This question was followed up by in-depth questions, such as *Can you give an example* or *Can you describe what you mean* to provide more in-depth description from the participants (Marton, 1986). The interviews lasted from 21 to 34 minutes and were conducted during the fall of 2015. All interviews were recorded and transcribed verbatim by the first author.

Data Analysis

Data were analyzed using phenomenographic analysis according to Marton (1986) and began with the text being read several times, by two authors, to get to know the

text. Thereafter, the text was read to identify appropriate quotes that were selected. Selected quotes constituted, as Marton (1986, p.43) describes it, "*the pool of meanings.*" The attention was moved from the individual subject, in this case the text, to the meaning embedded in the quotes. Step by step the content of "*the pool of meanings*" was differentiated and analyzed. Various quotes were thus merged into the categories of description based on similarities and separated based on differences. Categories were merged into a whole to describe the participants' perceptions of learning trauma care through simulation. All the categories were illustrated by quotations from interviews to reinforce the validity of the meaning of the categories (Marton, 1986).

Ethical Consideration

The study followed the ethical principals in accordance with the Declaration of Helsinki (2013) regarding anonymity and integrity. Ethical institutional review board approval and informed consent were obtained from all participants. The participants were informed about the voluntary nature of the study and that they could withdraw at any time. Quotes from the text are presented in such a way that participants cannot be identified. Only the authors have read the transcribed data.

Results

The result describes a variety of perceptions of the phenomena; learning high-energy trauma care through simulation. The results are presented in four categories of descriptions; *Learning through simulation*, *Learning through observation*, *Learning through debriefing*, and *Learning in a simulated environment*.

Simulation model	
Setting introduction	Participants are introduced to the goal of the simulation.
Simulation briefing	Participants get to know the simulation manikin, its features and familiarize themselves with the surrounding care environment.
Theory input	Review of, for example, the algorithms and concepts used during simulation.
scenario briefing	Participants are informed of the patient case and about the circumstances of care; where and when.
Scenario	Experienced based learning.
Debriefing	Performed as a reflective conversation and includes discussion and reflection based on the scenario. The debriefing is led by the facilitator who can also provide feedback on the actions undertaken during the scenario.
Ending	The whole exercise is summarized, and participants get support in identifying what they learned and how they can use the new knowledge in clinical practice.

Figure 1   The seven steps in the simulations model according to Dieckmann (2009). The scenarios were conducted, one scenario occurring every eight weeks, on the floor of the ambulance garage at the participants' ambulance stations on four occasions (Figure 2).

Scenario 1	Scenario 2	Scenario 3	Scenario 4
Severe injuries to extremities and pelvis as a result of a fall of 4 meters	High spinal injuries as a result of a dive head-first in shallow end of pool	Penetrating abdominal trauma as a result of a stab by a pair of scissors	Severe injuries to extremities and pelvis as a result of a motorcycle accident.

Figure 2   Patient scenarios performed by the nurses in prehospital emergency care.

Learning Through Simulation

Simulation of patients affected by high-energy trauma was perceived to train participants to think and work according to the systematic approach used in prehospital emergency care. Working systematically meant to include all essential parts of the care based on ABCDE. Participants learned to prioritize what was important in the care, which also meant being able to make a conscious decision on not using the ABCDE based on the patient's care needs.

Simulating trauma care was described as a good alternative to creating an experience from real patient situations. The experience was perceived to be lacking for the rare groups of patients. With simulated knowledge and experience, participants could with good quality of care be responsible for many different trauma cases and various patient cases.

> When you have simulated a situation once or more and then placed in a situation that is similar, you are not in uncharted territory. With the simulation experience, you are more secure with the reasonability of what and how to do things because you have exercised it.

It was perceived as positive that inaccuracies and forgotten care actions were discovered during the simulation. The participants described how awareness meant that they changed their care actions. It was perceived to ensure that care actions were not forgotten or performed incorrectly at the scene of the accident.

The simulation training was experienced confirming and maintaining knowledge as opposed to the loss of knowledge that was rarely or never used. By simulation, participants were made aware of their knowledge of trauma care. The knowledge was readily available in the participant's awareness to be used when needed. The participants perceived themselves being more prepared to care for a patient exposed to high-energy trauma. It was described to create a stronger self-esteem to be able to act at the scene of the accident.

Learning Through Observation

The participants described the learning experience in observing others simulate. To observe others meant that the participant got experience without acting as the responsible nurse during the simulation. The observation enabled reflection on the colleague's choice of assessments and care actions. Observing the colleague meant learning new things. This meant getting options on care actions that one could use.

> You see colleges do it during simulation and you adjusted your own way of working. It feels like you experience the situation before you meet the patient at the actual accident site. It is not the first time, and you know what to do.

It could also mean that you identified your own care actions being missed or incorrect. Being able to reflect on their own way of working made it possible to improve their way of working. The observation could also serve as a check and a confirmation that the participant had correct knowledge.

Learning Through Debriefing

The debriefings were perceived to be as important for learning as the simulation. To describe their thoughts opened up for reflections from the colleague and facilitator. Improvements or alternative care actions could be reflected on, and their own efforts could be corrected and improved. Mistakes being made could be adjusted, and things missed could be included.

Listening to how other participants were thinking during their simulation scenario gave an opportunity for reflections. Thoughts about whether the same way of working would be chosen or if other care actions had been selected was a learning opportunity for the participants. Experience from the conversation was perceived to have a similar value as if the simulation scenario had been conducted by the participant himself.

Listening to the colleague's previous experience of what had worked or failed at a scene of the accident in comparison with the simulation created a learning opportunity for the participant.

> To discuss alternative treatments and procedures that you used yourself or your college used. Thoughts on the materials and possible ways it can be used. You reflect on the consequences of each treatment when you hear others talk about it.

> You learn to see new possibilities in the trauma care.

The debriefing was integrated into the participant's knowledge and could be used in care situations where the participant had no prior experience. A prerequisite for learning at the debriefing was that the colleague and facilitator had the knowledge to be able to participate in the reflections. The facilitator also served as a guarantor that the theoretical knowledge was correct in the conversation. Positive feedback was perceived as important. The participant had difficulties to remember and focus on positive care actions performed during the simulation. Positive feedback meant being able to confirm an already competent care process.

Learning in a Simulated Environment

Some participants found that the absence of a prehospital setting reduced their experience of learning. Being exposed to darkness, cold and cramped crashed cars were considered to increase the stress level and the learning. Others described that the external impact of simulation on a

fictional scene of the accident with car wrecks was superfluous. They described how simulation could be done without the realistic environment.

> If you want to practice scooping up a patient out on a field, you need to do it out on a field. If you are training on assessment and care of trauma patients, you don't need to be out in a field.

The level of stress present in real trauma situations was lost with a manikin, which decreased the learning opportunity according to some. Still, others described how a systematic trauma approach could be learned with a manikin because the focus then was on the participants' actions and not on the patient. Some participants described how the learning experience was impaired because of the lack of visual indicators on the manikin that one normally sees on a human being. It meant that, for example, parameters such as skin color were missed if not explicitly requested.

> On the accident site, you rely heavily on what you see. During simulation with a manikin, you may miss things regarding the patient's condition because you did not think of asking about it.

Others perceived instead, how the lack of visual indicators resulted in a more methodical way of working. Not being able to rely on visual indicators meant that the assessment was carried out more carefully, and no important information was overlooked. All essential elements in the structured trauma approach were included. This meant that the participants learned the workflow necessary to perform trauma care in low-lit scenes of the accident.

Discussion

In this study, we describe nurses' perceptions of learning high-energy trauma care in prehospital emergency environment through simulation. The result shows how the simulation was described to enable learning and also experience for the nurses in prehospital emergency care to work according to a systematic trauma care approach, which meant including all essential elements in trauma care according to the ABCDE system. This systematic way of working means quickly identifying and treating patients with life-threatening injuries (Fortes Lähdet, Suserud, Jonsson, & Lundberg, 2009). No vital parts of the care actions are forgotten in the assessment, and all nurses in prehospital emergency care work in the same manner. A systematic approach according to the ABCDE can therefore, improve trauma care (Fortes Lähdet et al., 2009).

The nurses in prehospital emergency care perceived simulation to acquire knowledge and skills essentials for treating high-energy trauma. Working systematically, the nurses learned how to prioritize what was important in trauma care. They perceived that this systematic learning

also enabled them, when appropriate, to make a conscious deviation from the methodical ABCDE way of work.

The nurses conducted trauma care repeatedly during this study. By experiencing several different variations of trauma scenarios, they could develop memories of what to expect and how to act in trauma situations. Through repetition, participants learn what to look for, what to anticipate, and how to respond to what happens (Schön, 1991). Poikela and Poikela (2012) assert that reflection is the essence of simulation learning. In this study, reflections were made both during and after the simulation, which has previously been described as important for learning through simulation (Kelly, Hager, & Gallagher, 2014).

The debriefing was described as an important part of the learning experience, something previously also described in the context of simulation (Levett-Jones & Lapkin, 2014). The debriefing in this study included theoretical knowledge and recommendations on care actions that had been overlooked or executed improperly. According to Kihlgren et al. (2015), this represents a lower level of reflection, more as an idea about doing a care action differently. To encourage learning, the debriefing needs to facilitate a deeper level of reflection (Husebø et al., 2015). When a meaningful and skilled debriefing was provided, the nurses described how they could enhance their trauma skill practice. Kelly et al. (2014) describe how support of participants during debriefing encourages learning and reflection. For optimal learning during the debriefing, it needs to be based on the participants' previous experiences (Krogh, Bearman, & Neste, 2016). With a learner-focused debriefing, knowledge is accessible through reflection for both experienced and inexperienced nurses to support learning (Poikela & Poikela, 2012). This is particularly important for inexperienced nurses in prehospital emergency care who have a limited ability to appreciate the consequences of their decisions and care actions. The experience from the high-energy trauma simulation can, therefore, as this study shows, be brought into the nurses' professional competency in the prehospital context, which will directly benefit patients.

The nurses in the study had diverse opinions regarding how they perceived the manikin representing the trauma patient. The technical focus was deliberately withheld using a basic manikin without visual indicators. The focus was instead on learning. This was perceived, for some, as impairing their learning process. This is supported by Engström et al. (2016), who emphasize that when the prehospital training environment is contextualized, it contributes to a better flow in the simulated work and enhances realism for the participants.

Method Discussion

The phenomenographic method was based on perceptions of the learning experience. It targeted thinking and

behaving in the simulated trauma situation. The credibility of the study was strengthened by the open-ended questions asked to all participants, aimed at giving the participants possibilities to reflect on their own point of view over the phenomena. To further strengthen the credibility and validate the result, respondent validation was performed by four participants from the study, who read and confirmed the results of the study. Confirmability was strengthened by one author who conducted and transcribed all interviews. In control for biases, the authors' groups were used (Åkerlind, 2005). The transferability was strengthened through the selection process, which intended to provide the study with a wide variety of participants (Marton, 1997).

Limitations

One limitation may be that nurses in prehospital emergency care who are interested in trauma and in practicing trauma care agreed to participate in the study. This may have caused a higher level of knowledge within trauma care and therefore have influenced the results in a positive way.

Conclusion

In this study, we have concluded that regular simulation is perceived to increase knowledge and skills in trauma care among ambulance nurses. Trauma simulation establishes, corrects, and confirms knowledge and skills in a prehospital setting. Simulation reinforces a systematic care approach and provides insights into alternative care actions. Erroneous care actions are perceived as learning opportunities, which provide the nurses in prehospital emergency care a chance to correct their care actions. Debriefing is important for the simulated learning process. However, it requires skilled participants and a skilled facilitator to be optimally effective. When nurses in prehospital emergency care have access to regular simulation and debriefing, their knowledge and skills are readily available in memory and can be quickly retrieved in a future trauma situation.

References

Abelsson, A., & Lindwall, L. (2012). The prehospital assessment of severe trauma patients' performed by the specialist ambulance nurse in Sweden—A phenomenographic study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, *20*, 67.

Åkerlind, G. S. (2005). Variation and commonality in phenomenographic research methods. *Higher Education Research & Development*, *24*(4), 321-334.

Arman, M., Dahlgren, K., & Ekebergh, M. (2015). *Theoretical foundations of caring*. Stockholm, Sweden: Liber.

Benner, P. (2001). *From novice to expert: Excellence and power in clinical nursing practice*. Upper Saddle River, NJ: Prentice Hall.

Colleague of Paramedics. (2015). Paramedic curriculum guidance. 3rd ed. Retrieved from https://www.collegeofparamedics.co.uk/downloads/Curriculum_Guidance_2014.pdf

Declaration of Helsinki. (2013). *Ethical principles for medical research involving human subjects*. Helsinki, Finland: World Medical Association.

Dieckmann, P. (2009). *Using simulations for education, training and research*. Lengerich, Germany: Pabst.

Engström, H., Andersson Hagiwara, M., Backlund, P., Lebram, M., Lundberg, L., Johannesson, M., …, & Maurin Söderholm, H. (2016). The impact of contextualization on immersion in healthcare simulation. *Advances in Simulation*, *1*, 8.

Fortes Lähdet, E., Suserud, B. O., Jonsson, A., & Lundberg, L. (2009). Analysis of triage worldwide. *Emergency Nurse*, *17*(4), 16-19.

Garvey, P., Liddil, J., Eley, S., & Winfield, S. (2016). Trauma tactics: Rethinking trauma education for professional nurses. *Journal of Trauma Nursing*, *23*(4), 210-214.

Hagiwara, M. A., Kängström, A., Jonsson, A., & Lundberg, L. (2014). Effect of simulation on the clinical competence of Swedish ambulance nurses. *Australasia Journal of Paramedicine*, *11*, 2.

Husebø, S., O'Regan, S., & Nestel, D. (2015). Reflective Practice and Its Role in Simulation. *Clinical Simulation in Nursing*, *11*(8), 368-375.

Johnson, A., Ramos-Alarilla, J., Harilal, K., Case, D., & Dillon, E. (2012). HPS more effective than CD-ROM for improving cognition and performance. *Clinical Simulation in Nursing*, *8*(9), e443-e449.

Kelly, M. A., Hager, P., & Gallagher, R. (2014). What matters most? Students' rankings of simulation components that contribute to clinical judgment. *Journal of Nurse Education*, *53*(2), 97-101.

Kihlgren, P., Spanager, L., & Dieckmann, P. (2015). Investigating novice doctors' reflections in debriefings after simulation scenarios. *Medical Teacher*, *37*(5), 437-443.

Krogh, K., Bearman, M., & Neste, D. (2016). "Thinking on your feet"—A qualitative study of debriefing practice. *Advances in Simulation*, *1*, 12.

Lapkin, S., Levett-Jones, T., Bellchambers, H., & Fernandez, R. (2010). Effectiveness of patient simulation manikins in teaching clinical reasoning skills to undergraduate nursing students: A systematic review. *Clinical Simulation in Nursing*, *6*(6), 207-222.

Levett-Jones, T., & Lapkin, S. (2014). A systematic review of the effectiveness of simulation debriefing in health professional education. *Nurse Education Today*, *34*(6), 58-63.

Marton, F., & Booth, S. (1997). *Learning and awareness*. Mahwah, NJ: Lawrence Erlbaum.

Marton, F. (1986). Phenomenography—A research approach to investigating different understandings of reality. *Journal of Thought*, *21*(3), 28-49.

Marton, F. (1981). Phenomenography—Describing conceptions of the world around us. *Instructional Science*, *10*, 177-200.

PHTLS. (2014). *Basic and advances prehospital trauma life support. Prehospital Trauma Life Support Committee of the National Association of Emergency Medical Technicians in cooperation with the Committee on Trauma of the American Colleague of Surgeons* (8th ed.). St. Louis, MO: Mosby.

Poikela, E., & Poikela, P. (2012). *Towards simulation pedagogy. Developing nursing simulation in a European network. Publication series*. Rovaniemi, Finland: Rovaniemi University of Applied Sciences.

Schön, D. A. (1991). *The reflective practitioner: How professionals think in action*. Aldershot, England: Avebury/Ashgate.

Suserud, B. O., Bruce, K., & Dahlberg, K. (2003a). Ambulance nursing assessment. Part two. *Emergency Nurse*, *11*(1), 14-18.

Suserud, B. O., Dahlberg, B., & Dahlberg, K. (2003b). Initial assessment in ambulance nursing. Part one. *Emergency Nurse*, *10*(10), 13-17.

Suserud, B. O., & Haljamäe, H. (1999). Nurse competence: Advantageous in pre-hospital emergency care? *Accident and Emergency Nursing*, *7*(1), 18-25.

Swetrau. (2015). *Prehospital trauma care*. Stockholm, Sweden: Socialstyrelsen.