

Development and evaluation of a new simulation model for education, research and quality assurance in disaster medicine

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av

Kristina Lennquist Montán

Fakultetsopponent:
Professor Ulf Björnstig
Enheten för kirurgi
Institutionen för kirurgisk och perioperativ vetenskap
Umeå Universitet

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- I. Lennquist Montán K, Khorram-Manesh A, Örténwall P, Lennquist S. Comparative study of physiological and anatomical triage in major incidents using a new simulation model. *Am J Disaster Med* 2011; 6(5): 289-298
- II. Lennquist Montán K, Hreckovski B, Dobson R, Örténwall P, Montán C, Khorram-Manesh A, Lennquist S. Development and evaluation of a new simulation model for interactive training of the medical response to major incidents and disasters. *Eur J Trauma Emerg Surg* 2014; 40: 429-443
- III. Lennquist Montán K, Örténwall P, Lennquist S. Assessment of the accuracy of the MRMI-course for interactive training of the response to major incidents and disasters. *Accepted for publication, Am J Disaster Med, March 23, 2015*
- IV. Lennquist Montán K, Riddez L, Lennquist S, Olsberg AC, Lindberg H, Gryth D, Örténwall P. Assessment of hospital surge capacity using the MACSIM simulation system - a pilot study. *Manuscript*



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Kristina Lennquist Montán

Department of Surgery, Institute of Clinical Sciences
Sahlgrenska Academy at University of Gothenburg

ABSTRACT

Background: The risk for, and incidence of, major incidents has significantly increased during recent years. The goal for the health care systems is to eliminate or reduce loss of life and health, and physical and psychological suffering, as consequences to such incidents. This requires planning and preparedness, education and training of all potentially involved staff, and also research with development and scientific evaluation of methodology. Since a wide variety of factors influence the outcome of the response to such incidents and all these factors interact with each other, both planning, training and research require simulation models illustrating all these factors and their interactions. Very few simulation models covering all components of the response on a sufficient level of detail to meet the demands necessary for this purpose have so far been available.

Aims: The aims of this thesis were to

- Create and develop a new simulation model with the ability to:
 - Supply information on a sufficient level of detail to provide a base for decisions on all levels and all components of the chain of response, including individual patient management
 - Illustrate all consequences of such decisions
 - Give a measurable result of the response
 - Illustrate the multiplicity and severity of injuries in recent major incidents, such as terrorist actions
- Test and evaluate this model
 - As a scientific tool through comparison of different triage methods in major incident response
 - As an educational tool by development and validation of an interactive training program in major incident response for staff of all involved categories
 - As a tool for quality assurance by testing capacity and preparedness of a major hospital in response to a simulated incident, based on a real scenario

Results: As a method for comparison of triage methods, the simulation model illustrated differences in accuracy and outcome between the two principal methods, anatomical and physiological triage, for different categories of staff with different levels of competence and experience, providing a base for discussion when and where to use the different methods.

As a method for education and training, it provided the base for the start and development of an international training program, generating the establishment of seven international training centers in different countries based on this methodology. Validation of the training program showed that it accurately fulfilled the defined objectives for the training based on experiences from recent major incidents.

As a method for testing capacity and preparedness, it could be used to identify critical limiting factors for surge capacity in a major hospital and also illustrate how these factors interacted with each other and how different functions could be identified as limiting factors at different times during the response. It also provided a base for assessment and improvement of preparedness, organization and performance in major incident response.

Conclusions: The simulation model created, developed and evaluated in this project with the aim to provide a tool for research, training and quality assurance in major incident response:

- Appeared to meet the above defined aims for such a tool within all the studied areas
- Was evaluated to be accurate for its purpose by participating staff of all categories
- Supplied valuable new information and experience within all the tested fields in this thesis

Keywords: major incident, mass casualty, disaster medicine, simulation model, education, quality assurance, triage, surge capacity, MRMI, MACSIM

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