SurgeSim Visual

The Future of Emergency Department Simulation and Surge Capacity Evaluation

From MedStatStudio and Jeffrey Michael Franc Professional Corporation

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Executive Summary

Simulation is a valuable tool for evaluation and teaching in Disaster Management. However, traditional live exercise simulation is costly. In addition, traditional simulations often require interruption of the normal patient-care system, which can often be impossible to perform without compromises to patient care.

The SurgeSim Visual Simulator is a unique alternative to traditional simulation methods. This network-based tool is developed from a large database of simulated patients. During the exercise, participants connect to the SurgeSim server using their own laptop computers and any web-browser. Participants work as a team to manage a mass casualty incident. During the exercise, Emergency Department patients must be registered, triaged, assigned to rooms within the department, examined, and decisions regarding their final destination made. The simulation challenges participants to use the Disaster Plan, but also to use effective teamwork and to discover creative solutions to increase emergency department flow. Following the simulation, precise mathematical markers of patient flow, triage accuracy, and command-and-control indicators are available immediately and can be used to evaluate efficacy of the plan and to provide a structured debriefing to the participants. The simulation is highly customizable, and may be configured to represent any Emergency Department.

Typical teaching sessions require only four hours of participant commitment with no advance preparation necessary. The simulation software has been used with a wide variety of target audiences in the past for both educational and evaluative purposes with a very high degree of participant satisfaction.

Benefits to your organization

SurgeSim provides its customers with a unique simulation tool:

- Applicable to a wide variety of audiences including Administrative and Clinical Staff
- Allowing all normal healthcare operations to persist, requiring no cessation of services.
- Saving funds usually spent on planning and performing traditional exercises while using existing computer hardware.
- Providing immediate structured feedback for Disaster Plan evaluation
- Proven value for education in disaster management

Business Challenge

Although disaster preparation is mandatory for all areas within the healthcare system, teaching and evaluating this level of preparedness remains elusive. Unlike usual daily activities, Disaster Management cannot usually be measured directly, as although disasters represent high impact events, they are of low frequency. Simulation may offer a valuable means to teach disaster planning and evaluate preparedness.

However, simulations can be costly. In financial terms, provision of live exercise simulations can be financially challenging. Furthermore, a large time commitment is often necessary for planning a preparation of the exercise. Lastly, interruption of normal patient-care activities often cannot be tolerated.

To be effective, a simulation solution should:

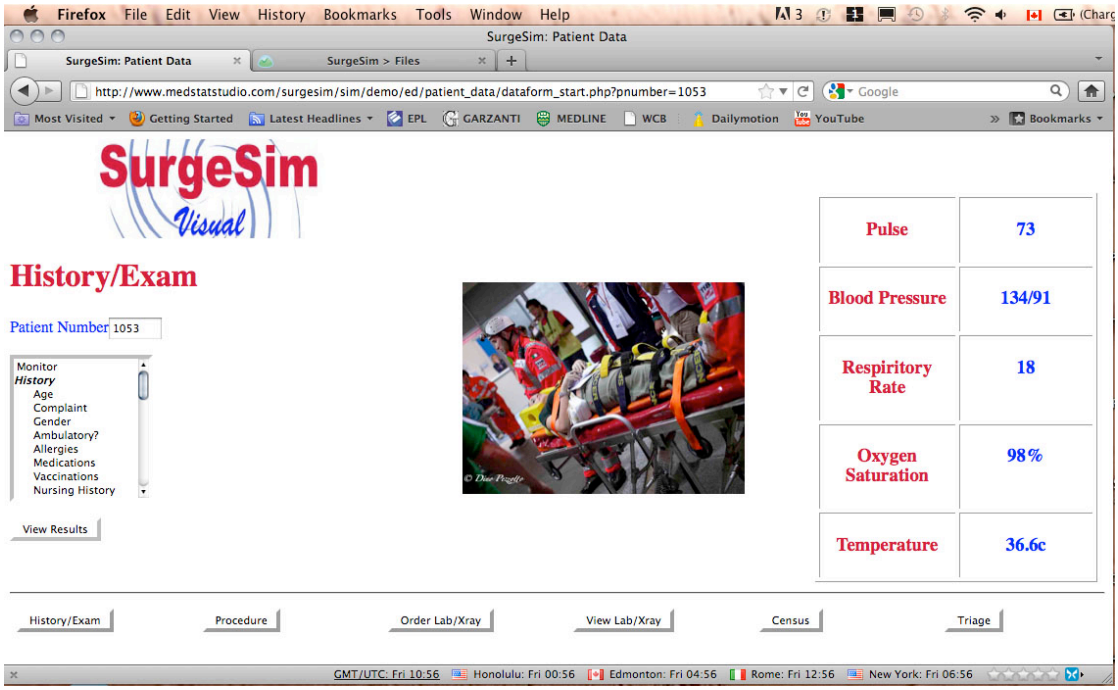
- Be widely applicable to a number of target audiences
- Be usable with minimal interruption of healthcare operations
- Be cost effective
- Provide immediately available structured feedback

The SurgeSim Visual Simulator provides a solution to each of these challenges.

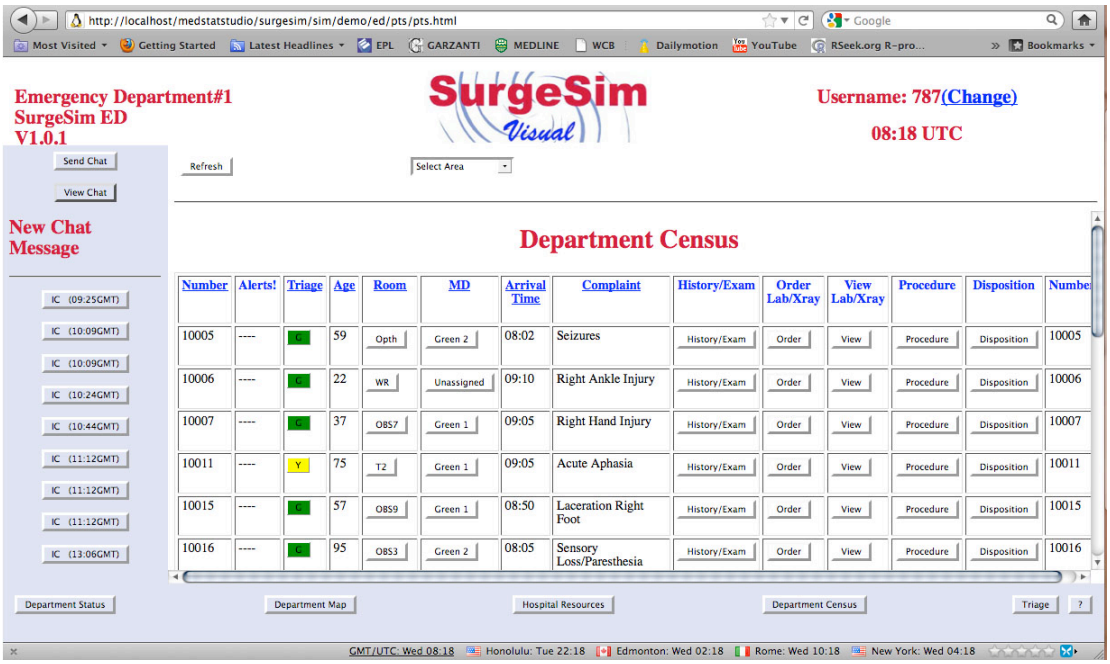
Challenge	Solution
Applicability	The SurgeSim Simulator has been used across a wide variety of audiences including Administrators, Physicians, Nurses, Allied Health Professionals, and Policy Makers
Interruptions of Operations	No interruption of normal operations is needed as the simulation is entirely computer based
Cost Effective	The simulation software license costs a fraction of the costs normally associated with simulations. Minimal advance planning is needed, and the simulation requires only four hours of time for each participant
Structured Feedback	Data analysis of the simulation can provide immediately available numeric benchmarks of Emergency Department flow

Solution Description

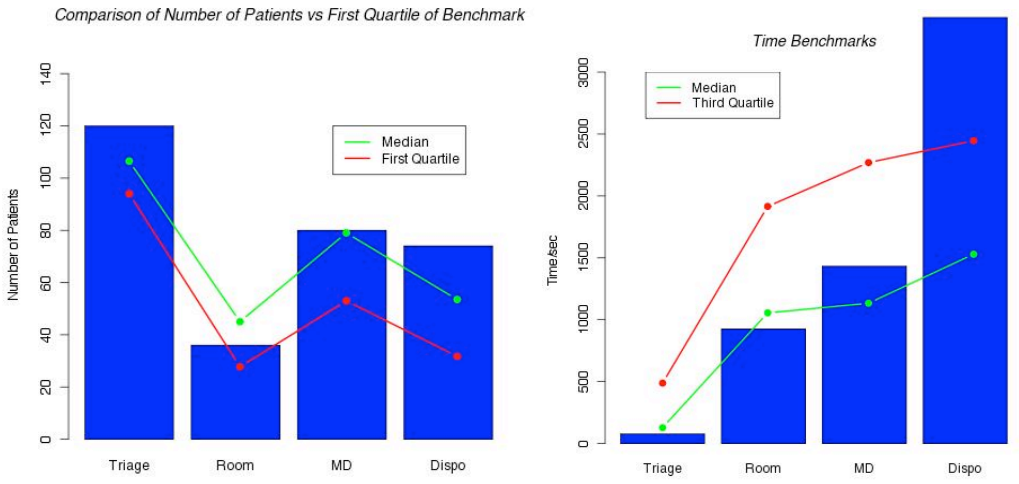
The SurgeSim Visual Simulation offers a network based simulation tool for Emergency Department management.



Simulation sessions are performed using any standard web-browser on participant laptop computers that connect to an ad-hoc wireless network. No additional computer hardware purchases are necessary. Typical simulation sessions last approximately four hours, and begin with a short tutorial on command-and-control, followed by a tutorial session lasting approximately forty-five minutes where participants are given a brief lecture on the software use and ample time to practice with a sample set of patients. During the disaster simulation, participants work as a team to manage the simulated disaster. Actual disaster management is left entirely to the discretion of the participants who may develop their own command-and-control structure and overall approach to the incident. Trained moderators at each session are present to simulate consultant physicians, administration, and hospital support staff. A highly desirable feature of the SurgeSim software is that the exercise management staff can customize many parameters of the hospital disaster response during the simulation. This encourages participants to develop creative solutions to enhance emergency department flow. For instance, participants may request such manoeuvres as increasing number of beds in each ED room, or transferring inpatients between wards.



Since there are no universally accepted metrics for surge capacity, ten suspected metrics are investigated. This included four time markers, four patient number markers, triage accuracy, and command-control indicators. The four time markers included time from patient arrival to (1) Triage, (2) Room Assignment, (3) MD Assignment, and (4) Disposition. The four patient number markers include total number of patients during the simulation to be (1) Triaged, (2) Assigned to a room, (3) assigned to an MD, and (4) disposed. In addition, triage accuracy is compared to the CTAS number from the database. Command and control markers are also assigned by trained observers using a web based evaluation tool.



Solution Benefits

SurgeSim offers a unique alternative to traditional simulation methods by:

- Allowing objective testing of Emergency Department disaster management
- Using only existing computer hardware, requiring no new computer hardware purchases
- Providing a tool which is both evaluative and instructive
- Requiring minimal preparation time
- Customizing simulation training to individual sites

SurgeSim allows all this while still being applicable to a wide audience, requiring no interruption of normal operations, being cost effective, and providing immediately available objective markers of Disaster Management Performance.

Participant satisfaction with the SurgeSim software is exceptionally high, with nearly 100% of participants stating they preferred the simulation to more traditional (didactic) methods of teaching.

Technical Specifications

The SurgeSim Visual Editor is based on a database of simulated patients and a network based webserver application.

A MySQL (Oracle, Redwood Shores, California, USA) database of simulated patients includes all relevant details such as history, exam, past medical history, laboratory results, and imaging results. Histories are modified slightly to place the patients into one of three disaster scenarios: motor vehicle collision, airplane crash, or pandemic influenza. Triage codes assigned by computer assisted Canadian Triage Acuity Scale (CTAS) were also documented. Triage codes are also translated to the START algorithm as this method appears to be more frequently used worldwide. The database also contains a selection of non-disaster patients to replicate baseline ED flow. Patient data was initially obtained in English but also translated to Italian. A PHP (PHP: Hypertext Processor, PHP Group) program allows creation of customized disaster patient datasets by specifying a number of initial parameters including number of patients, disaster scenario, length of simulation, DeBohr acuity index, baseline ED patient flow, and delay to first patients.

Data from the patient database is selected to provide patients for ED simulation using the simulation software SurgeSim (MedStatStudio, Edmonton, AB, Canada). The software is web-based simulation written in HTML (hypertext mark-up language, World Wide Web Consortium) and PHP. The software is powered by an APACHE (Apache Software Foundation) webserver that is located on a laptop computer using either the SUSE Linux (Novell, Provo, Utah, USA) or Macintosh (Apple Inc., Cupertino, California, USA) operating system. The simulation software – which resembles as an ED tracking software - was developed in English and Italian. SurgeSim is highly customizable, including parameters such as ED layout, hospital resources, radiology resources, and delays for specific procedures. Because the software is designed to be performed in real time, procedure delays for various procedures and labs were estimated by informal observations at the University of Alberta Hospital. Patients in the simulation software develop over time, and are responsive to participant actions. For instance, a patient with a pneumothorax on arrival who has a chest tube placed will show improvement in vital signs and will then have an X-ray showing the chest tube placement and resolution of the pneumothorax. Conversely, the same patient will proceed to respiratory arrest if untreated. During the simulation, thousands of data points are saved into MySQL databases including such markers of patient flow, resource use, procedures performed, and bed occupancy.

Participants require no client-side software. Only a laptop computer with Wi-Fi access and a commercially available web-browser (e.g.: Internet Explorer, Safari, or Firefox) are

required. In general, participants will use their own laptop computers. Server hardware is supplied by MedStatStudio and is included in all pricing options.

Although the simulation is customizable, two simulation protocols were developed: one for a mass trauma incident (Geyserville) and a second for pandemic influenza. These protocols allow multiple groups to perform the simulation using the same hospital department and same patients to provide direct comparisons between.

Simulation data is analysed using a customized function (Radmac) written in R (R Development Core Team, Vienna, Austria) statistical software language, which directly probed the MySQL database of the SurgeSim software. An extremely useful feature of the statistical software is that it is cumulative. That is, markers are adjusted with each simulation run, and the software essentially "learns" what the benchmarks should be on a cumulative basis. Data analysis is available immediately and is used to provide a structured debriefing to the participants.

Details of the proposed solution

Each simulation is customizable to the target audience, however each four-hour session generally consists of the following components:

Component	Time Commitment
Introductory Lesson: Command-and-Control	50 Minutes
Group Exercise: Incident Command System	20 Minutes
Tutorial: SurgeSim	20 Minutes
Independent Practice with the Software Facilitated by Management Staff	30 Minutes
Refreshment Break	15 Minutes
Simulation Exercise	90 Minutes
Debriefing and Feedback	15 Minutes

Following each session, specific data including performance against standardized benchmarks, triage accuracy, and scoring on the command-and-control markers will be made available to the exercise sponsor within 72 hours.

Target Market

The SurgeSim Visual Simulator is widely applicable across a broad range of users. Although the simulator is primarily a tool for Emergency Department simulation, it is useful across a variety of audiences for a team -building exercise and for teaching the mechanics of disaster response and disaster plans.

Potential target audiences include:

- Emergency Department Physicians, Nurses, and Support Staff
- Emergency Department administration
- Hospital department and site administrators
- Zone medical leads

Case Studies

The SurgeSim Visual Simulator has been used by a number of customers for both training and evaluative needs including:

- The United Nations
- European Master in Disaster Medicine
- Segretariato Italiano Studenti in Medicina
- Università degli Studi del Piemonte Orientale “Amedeo Avogadro”

In addition the software has been used at many conferences worldwide as a short course in Disaster Medicine.

Summary

The SurgeSim Visual Simulator represents a unique method for Disaster Management education and evaluation. In contrast to more traditional methods of simulation, the simulation is applicable to a wide variety of target audiences including Administration and Clinical Staff. The computer-based simulation requires no interruption of existing services. The software solution is cost effective, as it requires no additional computer hardware purchases, and eliminates hours of employee preparation time usually required for development of simulation scenarios. Finally, SurgeSim allows immediately available feedback in the form of precise mathematical measurement of markers of department flow.

Contact Us

MedStatStudio

937 Haliburton Road

Edmonton AB T6R 2Z6

Email: jeffrey.franc@gmail.com

Website: www.medstatstudio.com

Tel: +1 780 700 6730

Fax: +1 780 437 9673

More Information

For the latest information about our product and services, please see the following resources:

http://www.medstatstudio.com

http://www.surgesim.com/

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