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Simulation and management games for training command and control in emergencies

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Abstract

The aim of our project was to introduce and implement simulation techniques in a problematic field of increasing health care system preparedness for disasters. This field was chosen as knowledge is gained by few experienced staff members who need to disperse it to others during the busy routine work of the system personnel.
Knowledge management techniques ranging from classifying the current data, centralized organizational knowledge storage and using it for decision making and dispersing it through the organization-- were used in this project.
In the first stage we analyzed the current system of building a preparedness protocol (set of orders). We identified the pitfalls of changing personnel and loosing knowledge gained through lessons from local and national experience. For this stage we developed a database of resources and objects (casualties) to be used in the simulation in different possibilities. One of those was the differention between drills with trainer and those in front of computers enable to set the needed solution. The model rules for different scenarios of multi-casualty incidents from conventional warfare trauma to combined chemical/toxicological as well as, levels of care pre and inside hospitals- were incorporated to the database management system (we used Microsoft Access' DBMS). The hardware for management game was comprised of serial computers with network and possibility of projection of scenes. For prehospial phase the possibility of portable PC's and connections to central server was used to assess bidirectional flow of information. Simulation software (ARENA) and graphical interfase (Visual Basic, GUI) as shown in the attached figure.
We hereby conclude that our system provides solutions which are in use in different levels of healthcare system to assess and improve management command and control for different scenarios of multi-casualty incidents.

Keywords:

Simulation games, Triage, Mass casualty incidents

1. Introduction

The aim of our project was to introduce and implement simulation techniques in a problematic field of increasing health care system preparedness for disasters. This field was chosen as knowledge is gained by few experienced staff members who need to disperse it to others during the busy routine work of the system personnel [1, 2].

Knowledge management techniques ranging from classifying the current data, centralized organizational knowledge storage and using it for decision making and dispersing it through the organization-- were used in this project [3].

Planning and drilling are the ways to minimize deviations from the guidelines and avoid management mistakes [1-3]. Therefore, the hospital team is supposed to be involved in series of drills from theoretical to full scale in order to test the practical solution. Dr Hirshberg is right in pointing out that the real ability of the hospital should be estimated by the number of trauma teams the hospital can recruit for the care of immediate-care casualties [1].

In building the strategy for treating trauma patients during a MCS, a few assumption are taken into account. The goal of care provided in a MCS is to deliver an "acceptable" quality of care to preserve as many lives as possible, and to prevent complications [1, 2]. Planning and drilling are the ways to minimize deviations from the guidelines, eliminate mistakes in management, and reach an acceptable threshold set to every hospital faced with MCS. Logistic aid and plan are needed for providing the medical supplies and equipment that should be available for immediate use. The most serious problem in MCS remains the temporary lack of an adequate staff.

The experience of a German group with the coordination of the incident supervisor and ground ambulance evacuation is described in details [4]. In a consecutive series 21 incidents with more than ten casualties Mentges et al. found that in 90% of all cases enough physicians were available to treat each seriously injured patient and in only 9 cases executive incident management teams were sent out and reached the scene about 25 min after. However, there was a severe documentation gap between what was recorded and happened on scene. Therefore, they conclude that communication skills, knowledge, and understanding of the benefits of on-site supervision structures need to be promoted [4].

Both manual and computerized simulation techniques are in use. In both, a dynamic shell simulates and reflects the design and functioning of the hospital; the external and prehospital organizations, and the development of events. The dynamic development includes various disaster events, patient flow (quantity, type and severity), local obstacles and adverse events, and the effects of decisions on the developing situations [3,5].

2. Description of solution

Analysis of treatment systems

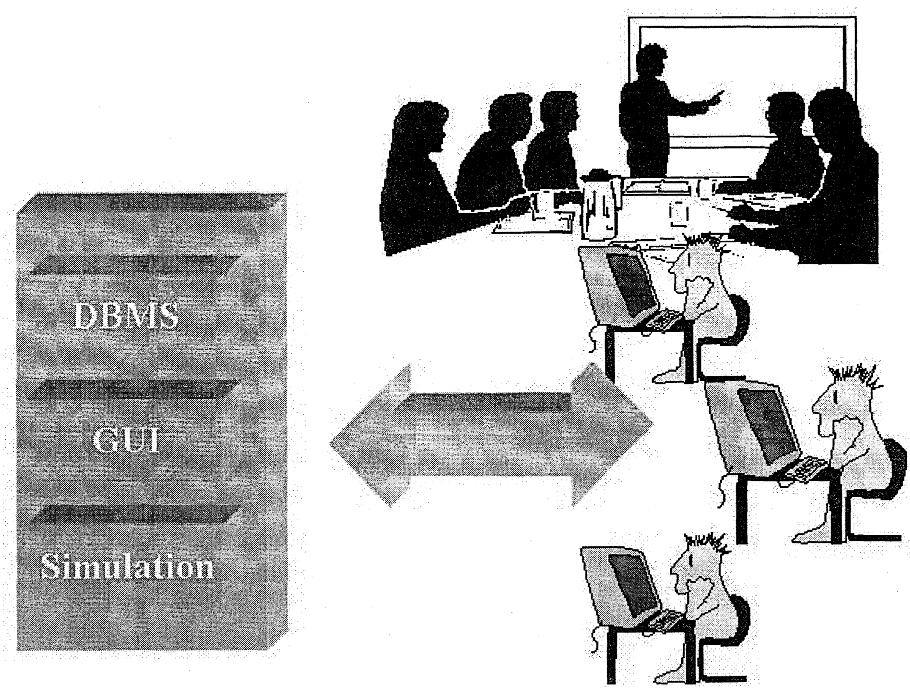
In the first stage we analyzed the current system of building a preparedness protocol (set of orders). We identified the pitfalls of changing personnel and loosing knowledge gained through lessons from local and national experience. For this stage we developed a database of resources and objects (casualties).

Setting the model rules

Differentiating between drills with trainer and those in front of computers enable to set the needed solution. The model rules for different scenarios of multi-casualty incidents from conventional warfare trauma to combined chemical/toxicological as well as, levels of care pre and inside hospitals- were incorporated to the database management system (we used Microsoft Access' DBMS). Knowledge and database for a basic multi casualties incident (MCI) was developed in the pilot phase. It contains detailed casualties description, to be compared with the real hospital capabilities (staff and infrastructure). A consensus committee decided on the crucial model issues and set the thresholds for quality performance indicators. Interfaces to the different hospital's information systems (IS) was developed and the various output documentation of each exercised step were updated. Before drilling, the hospital managerial staff got a notice and had to prepare the data on the anticipated resources. The

Figure 1:

simulation system architecture



simulation staff, as well as representatives from the hospitals, then conduct the limited scale drill (LSD).

Conducting the simulation game

The hardware for management game was comprised of a network of computers and possibility of projection of scenes. For prehospial phase the possibility of portable PC's and connections to central server was used to assess bidirectional flow of information. Simulation software (ARENA) and graphical interface (Visual Basic, GUI) as shown in the attached figure.

The case of prehospital teams

This management simulation game was aimed at drilling command and field personnel of EMS. First it gives information added by graphic interface of the event and scene. Secondly it assess the data gathered by the teams on scene and the way to support managerial decisions. During the propagation of the drill the teams and command center sharing knowledge and assess new input. To make it more complexed the command team might deal with additional incidents or resource problems in order to test their ability to conduct their job.

Limited scale drill for hospital management

During the LSD, the trained hospital staff got two kinds of input: 1) copies of reports on patients entering the stations and had to feed its IS; 2) timed phone notifications of problems in each station. During a 90 minutes drill there were about 15 timely reports and 20 phone problems. The evaluation of the LSD were mainly based on the following:

1) observing the staff solving various problems;
2) constructing a detailed picture of the situation;
3) measuring the effectiveness of the hospital IS.

The drill ended with a discussion. Lessons are drawn from each drill in order to find methods for optimizing the conduct of the hospital. An aimation tool proved to be useful in describing bottle necks in emergency room, diagnostic department and operating rooms.

3. Conclusions

We hereby describe a solution which is in use in different levels of healthcare system to assess and improve management command and control for different scenarios of multi-casualty incidents.

We have presented here a computerized simulation system which incorporates an activation program and user interface (data base screen). The problems and limitations of this technique are well known: it is based on a wide scale database and needs expensive investment in developement of the model and the validation of its use.

We found that the described simulation techniques used in preparatory limited scale drill has advantages in evaluating and improving preparedness of hospitals for managing an MCI before a full scale drill is done. The current system is operational in all hospitals in Israel which has to be prepared for MCI [2].

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