Analysis of a German First Responder Exercise: Requirements for Exercise-Support and Simulation

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ABSTRACT

The work of first responders is marked by unpredictable situations, quick decisions and peak performance. Gathering all important information related to an emergency situation forms the basis for a meaningful and purposeful planning and action. For example during an accident scene the execution of complex individual orders is crucial. The many rescue facilities, rescue vehicles, and first responders needed lead to complex workflows. Real-life exercises are necessary to train controllers and first responders in handling these special situations, but are difficult and costly to organize. This paper gives a short overview of such an exercise and draws a rough practitioner-based vision of a potential simulation-based interactive system that could support exercise leaders and decision makers towards an effective utilization of real-life exercise data.

Keywords

Mass Casualty Incident, Pre-triage, Exercise, Training, Simulation

INTRODUCTION

Real-life exercises have a set of limitations: first, there is a lack of possibilities to vary the location and condition of the injured. Further, it is difficult to achieve realistic time and capacity constraints. Costs in time and money to prepare the exercise, the risk of accidents and the impossibility to repeat the exercise in every detail are further major constraints. However, training gained from real-life exercises is imperative. In case of a mass casualty incident, the normal medical treatment of one patient would lead to deficits in the primary care of other severely injured. Computer-based training systems allow crisis managers to gain insights they normally gain during real-life experiences without the aforementioned limitations. Information gathered during real-life exercises now can serve as crucial input for such simulation systems. Further, as a major benefit, the exercise itself could be supported by reporting, debriefing, evaluation and what-if/forecast functionalities. This paper briefly describes a basic vision towards strengthened training, debriefing and planning for mass casualty incidents by behalf of a real-life scenario-based exercise observation of a rural first responder unit in Germany with subsequent interviews at district level in summer 2012. In the following scenario description of a mass casualty incident, each phase of the emergency process is enhanced by output data from the exercise, by user needs, and by rough use case descriptions for the envisioned exercise-support system.

SCENARIO DESCRIPTION

The training scenario concerns a bus that crashes into a car leaving 50 people injured (located in the bus and inside the car). Field experts argue hereby that this kind of scenario could happen everywhere and every time.

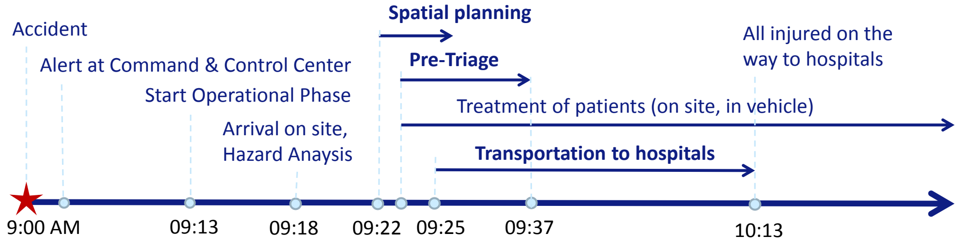

Figure 1: Scenario Timeline

As soon as the first responder unit arrives at the accident scene, a hazard analysis is conducted based on a standardized checklist. For the units and the patients, it is of particular importance that a further treatment, after the patients have been rescued, happens outside the damage zone. This zone is a determined area around the accident scene. Based on the results of the hazard analysis, the spatial planning of the rescue vehicles on site must be carried out. After that, the unit arriving at first on site starts with a categorization of all people involved in the accident, the so-called pre-triage. Three crucial phases of the first responder process (bold text in Figure 1) will be described in detail in the following sections.

Spatial planning

The aim of the planning must be to position the vehicles of all participating organizations with high efficiency while ensuring a high level of security. Due to limited space around the damage zone, in practice this is often a very big challenge. For the concrete scenario of 50 injured, vehicles are not sent directly to the incident, but to a so-called vehicle queue area that is near the scene. Therefore, proper arrival, parking order and departure workflows must be defined and communicated to the drivers.

Output data: time units needed to establish parking order, correct/incorrect implementation of workflows.
User needs: integration of local maps, location and capabilities of civil protection units (e.g. fire fighters, emergency services, aid organizations and hospitals), workflow times (walking with patient stretcher) dependent on vehicle positions, Simulation of different alternatives to position patients depot and an optional vehicle queue.
Use cases during exercise: exercise data steward: maintain geographic locations for live-monitoring, exercise leader: exercise-monitoring, estimation of the effectiveness of different spatial strategies for exercise debriefing.

Pre-triage and transportation to patient depot

The aim is to identify traumatised patients, to label them and to transport the severely injured ones within the classification I (red) as quick as possible out of the damage zone. This classification I patients are treated first (life-saving measures) on site at a collecting point called "patient depot" and/or in the rescue vehicles on the way to the hospitals. The seriously injured and slightly injured patients (classification II (yellow) and III (green)) are treated after they have been carried out of the damage zone to the patient's depot – as soon as sufficient responder units are available.

Output data: time of ways out of the damage zone to the patients' depot/vehicles, available responders for carrying – according to workload and personal physical prerequisites of the responders.
User needs: integration of validated medical data on criticality durations, patients behaviour including their disease or injury patterns dependent on time and the type of medical treatment.
Use cases during exercise: exercise data steward: assess triaged patients from the first responders in training/patient actors, exercise leader: identify problems during the pre-triage, monitor capacity bottlenecks.

Transportation to the hospital

As soon as a new patient is ready to being transported, the on-scene commander orders an appropriate vehicle from the vehicle queue area to the patients' depot in order to implement the departure workflow and carry him/her to the hospital that has adequate capacities. Accident-caused road barriers may hinder a quick departure.

Output data: time vehicle/helicopter needs to arrive at the hospital/at the incident scene again.
User needs: the integration of local road maps, geo-referenced collection of all hospitals in the districts around (150 km), real-time data on surgery capacities in the hospitals, real-time traffic data, data on weather conditions.
Use cases during exercise: exercise data steward: gather data from command vehicle/command and control center (if part of the exercise), exercise leader: report problems with vehicle queue and departure workflow.

CONCLUSION

After describing the exact proceeding of a first responder exercise, we extracted output data, user needs and use cases for three relevant phases. Output data to be gathered during real-life exercises now can facilitate reporting, debriefing, evaluation and what-if/forecasts by being integrated in interactive simulation systems. Additionally to supporting exercises themselves, simulation-based information systems can support decisions for planning and preparedness purposes.

For many mass casualty scenarios, the operational phase is very similar to this scenario. During the treatment of seriously injured people (Classification I) the factor time is crucial. Simulation tools allow a region-specific repetition of a training, the user can assess the outcome and incorporate the lessons learned into the daily work. Thus it is possible to develop optimal tactical schemas that lead to improved operations, training and capacity/resource planning.

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