

benefits of using VR simulation. Participants commented that compared to table-top exercises, a VR simulation compels the interaction and coordination of different stakeholders on site, and is beneficial in situations where communication between different parties is necessary, such as towards the wider public.

Conclusion: VR simulation can be a beneficial method for training for command and coordination in case of emergencies in mass gatherings.

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Enhancing Disaster Preparedness Exercises with Virtual Reality Simulations

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Study/Objective: The National Library of Medicine (NLM) is studying virtual reality simulations as tools to improve the Incident Command System proficiency of professionals playing emergency management roles through scenario-based exercises. Medical facilities identified a number of deficiencies in traditional methods. The NLMs approach aims to improve instructional outcomes by: increasing trainee engagement, promoting more frequent exercising, providing enhanced scenario realism, allowing for objective exercise assessments, reducing the impact of exercises on facilities' day-to-day activities, and improving exercises' cost-benefit ratio. The NLMs approach makes use of computer gaming and instructional design techniques to develop tools that others can use freely to implement scenario-based exercises.

Background: Since 2008, NLM collaborates with the Bethesda Hospital's Emergency Preparedness Partnership (BHEPP) in Maryland to enhance the preparedness of this coalition to respond to a crisis that may affect the National Capital Region. Hospital Incident Command System training was identified as an important preparedness component. NLM applies a variety of information, library, and computer science disciplines to support the goals of this coalition.

Methods: NLM developed application prototypes and instructional materials, prepared and conducted virtual ICS exercises in a local hospital, and collected participant's input through interviews, limited surveys, and during post-exercise "hot wash" meetings. The outcomes from these field tests guided the development of enhanced prototypes that were tested via additional exercises, some with other entities, including a county and a city Emergency Operations Center.

Results: Virtual exercise participants reported benefits in all the intended objectives. Over 90% of participants envision this type of training as a regular part of their preparedness training.

Conclusion: Preliminary results suggest that NLMs virtual ICS training can enhance ICS training. Creating the simulation software can be costly, but NLM is developing tools that can reduce adoption costs for organizations that want to try this training method, and the resource can be reused repeatedly at no significant cost.

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Simulation Exercises as Training and Evaluation Tool in an Ebola Preparedness Project

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Study/Objective: Designing a simulation exercise to evaluate a project that aims to prepare Health Care Workers (HCW) to identify and manage patients with highly contagious diseases.

Background: HCW were the most vulnerable persons by consulting and treating patients without sufficient protection during the Ebola outbreak in West Africa. In order to strengthen these key persons, the European Forum for OS-9 (EFFO) project with a train-the-trainer-program was initiated in 2014 by the Robert Koch Institute, STAKOB (German permanent working group for highly contagious and life-threatening diseases). The project is financed by the German Federal Ministry of Health. Evaluation and quality control play a crucial role in the train-the-trainer program.

Methods: Key aspects for the exercise with a single simulated patient were modified from previous projects for biological event preparedness evaluation. Certain aspects were highlighted as a result of the formative evaluation during the training program. The simulation directions were adapted for the local health care facility in Senegal. The general design, principles, and exact data were discussed with the responsible personnel. A precise debriefing similar to a tabletop exercise was conducted.

Results: This simulation exercise allows the identification of strengths and weaknesses. Eg, while the use of Personal Protective Equipment (PPE) was professional, the waste management remained a challenge. The method was highly accepted by the health care facility. The results were used to improve the train-the-trainer program.

Conclusion: Simulation exercises play a key role in biological events to prevent nosocomial infection. Training in PPE is essential, as well as practicing the context to achieve a transfer of training knowledge to a real suspected case. In this project, the simulation exercises will be used to evaluate and further adapt the train-the-trainer-program, to improve the preparedness of health care facilities, and to strengthen the network within the project.

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Pilot Study: Utilization of Simulated Exercises to Teach Healthcare Students the Potential Benefits of Unmanned Aerial Vehicles to Respond to Environmental Health Issues Associated with Disasters

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Study/Objective: To develop a simulated disaster scenario to demonstrate the potential benefits of UAVs.

Background: Climate change, emerging infectious diseases, global terrorism, and world conflict are increasing the likelihood that disasters in the 21st century will have greater catastrophic consequences than what was experienced in prior epochs. Innovative technologies must be devised and exploited to address these challenges. Unmanned Aerial Vehicles (UAV) have the potential capabilities to be used in preparation for, and response to, disaster situations in an expeditious and safe manner. However, this potential has not been fully explored.

Methods: Within a 3-hour semester Environmental Health course, a disaster exercise (floods) was created to explore how temperature changes, water contamination, infectious diseases, and bites and stings impact uniquely vulnerable populations. Within that scenario, students, employing the Incident Command System (ICS), used an UAV to survey that disaster area - searching for stranded victims and then ferrying needed resources (nutritional, cover, communications, etc.) to them. The UAV had visual capabilities to locate "victims" within the classroom (60x50x20), and then returned to base to be outfitted with paper "supplies" for the return trip. A questionnaire was completed by the learners.

Results: Within a 3.5-hour Environmental Health class, learners not only explored the severe environmental issues seen with disasters, but became ICS players using the drone to locate victims and to provide life-sustaining resources. The majority of the class indicated simulation training using UAVs was educational and instructive and should be included in global and disaster medicine curricula.

Conclusion: UAVs in limited fashion have been deployed in disasters. We have demonstrated that knowledge of this resource can be presented in a classroom setting using innovative simulation techniques. The learners' positive review has reinforced the opinion to expand this simulation to additional students in other related courses.

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Modeling Fear-Related Behaviors as Vectors of Transmission in the West Africa Ebola Pandemic

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Study/Objective: Describe/model Fear-Related Behaviors (FRBs) that exacerbated viral transmission during the Ebola pandemic, and analyze potential for intervention.

Background: Diminishing the multinational spread of infectious diseases is an international health priority. The West Africa Ebola Virus Disease (EVD) pandemic was the largest, longest, deadliest, and most geographically expansive ever. Fear-Related Behaviors (FRBs) were drivers of viral transmission. Cascades of escalating risk occurred as EVD provoked fear and associated FRBs that propelled disease spread; rising case counts then triggered more waves of FRBs.

Methods: A team of infectious diseases, complexity sciences, and psychiatric experts are modeling the contribution of FRBs to infectious disease spread, based on retrospective analysis of the West Africa outbreak. This is a critical endeavor because

behavioral risks for infectious disease transmission may potentially be prevented or mitigated. In the West Africa outbreak, behaviors such as avoiding or fleeing treatment units, caring for patients at home, and performing secret burials facilitated direct contact viral transmission.

Results: Preliminary analysis indicate that a high proportion of early cases in the West Africa Ebola outbreak were potentiated by FRBs. The serial nature of person-to-person infectious disease transmission, amplified the effects of FRBs on epidemic dynamics. Modeling results will be presented that estimate the proportion of the 28,600 cases that were either directly or indirectly triggered by FRBs.

Conclusion: This multi-disciplinary approach, incorporating spatio-temporal modeling of disease spread, on-scene observation of behavioral contributions to the risk of EVD spread, and the "lens" of complex systems thinking, has enriched the process of explaining the role of FRBs. Infectious diseases generate fear of contagion and associated FRBs that may paradoxically increase transmission risks. The West Africa Ebola outbreak serves as a laboratory for examination of FRBs, in relation to transmission and the potential for prevention and mitigation. These investigations have relevance for healthcare surge and related disaster medicine applications.

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The Use of Table-Top Simulation for Team Training in Disaster Events

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Study/Objective: A pre- and post-intervention study was conducted to find out if a table-top team training program would positively affect perception towards teamwork and their ability to recognize the presence and quality of team skills in disaster events.

Background: Since disaster training involves coordination and communication between various units of treatment, training this coordination and communication necessitates involvement of the whole chain of response simultaneously. To do this as a full-scale exercise is expensive and time consuming. Table-top simulation training modules gives us the advantage of a reflective, experiential, repetitive, and safe learning environment. By using the table-top simulation module, we believe we could train teamwork competency for disaster medicine providers.

Methods: The educational intervention consisted of a half-day workshop (lecture, table-top simulation, and debriefing) for a selected 48 health care providers from the emergency department. A Teamwork Perceptions Questionnaire (TPQ) was performed using tools developed by the TeamSTEPPS[®] Project (5-point Likert scale). Team Performance Observation Tool (TPOT) was used to evaluate the performances of the participants. The questionnaire and tool were modified to fit our institutions' culture. All pre-to-post differences within