

A pilot study on the use of a computerized surge capacity simulation exercise in a low resource environment: an evaluative tool for hospital preparedness and a training tool for students attending a course in emergency management in low resource environments.

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INTRODUCTION: The effect of lack-of-resources on surge capacity may potentially be an important factor in management of disasters outside of highly developed countries. Ability to predict in advance which areas are likely to be problematic and to train volunteer physicians to cope with these issues is paramount for disaster preparation in low-resource areas. In this pilot study, surge capacity simulation software was used in both an evaluative role – as a prediction tool for surge capacity in a low resource environment- and a training tool for students to gain a virtual experience in low resource emergency department management in a risk-free environment prior to embarking on humanitarian efforts. The primary purpose of the was to compare surge capacity in a limited resource simulation to that of the same simulation scenario performed with much higher resources. The null hypothesis of no change in patient flow with the reduction of resources was tested against the two-sided alternative hypothesis of significant change in patient flow. A secondary objective of this pilot study was to describe participant satisfaction with the exercise.

METHODS: Five residents taking part in a course in humanitarian medicine at the Università degli Studi del Piemonte Orientale in Novara, Italy, and five medical students from the university's medical school were invited and gave informed consent for participation. Participants received a one-hour lesson in emergency department command-and-control (Incident Command System) followed by a 1-hour tutorial in use of the simulation software (SurgeSim, MedStatStudio, Edmonton, AB, Canada). During the 1-hour simulation, participants managed the emergency department response to a large multi-airplane collision. Human resources were limited to the 10 participants with no further staff available to assist. Hospital resources were limited to 1 X-ray Machine, basic laboratory tests, 2 patient monitors, and 2 ventilators. There was no advanced imaging equipment, defibrillator, or intensive care unit. The nearest referral hospital was 4 hours away by ground transportation. Following the 1-hour simulation, participants were asked to complete a brief and anonymous feedback form. Statistical analysis included analysis of four key milestones of patient flow: 1) Triage, 2) assignment to bed, 3) assessment by a physician, and 4) disposition decision. The number of patients to reach each milestone, and median time from arrival to each milestone was compared to 85 previous simulations using the same simulation patients but with standard levels of resources. Results were considered significant if the number of patients to reach any particular milestone was less than the 25%ile or if the median time to reach a milestone was greater than the 75%ile. Analysis of the survey results including only summary statistics.

RESULTS: The number of simulated patients reaching each of the four milestones was above the 25%ile in the experimental group. Time required to reach each milestone was below the 75%ile for all four milestones except time for arrival to disposition decision, which was significantly longer. All 10 participants completed the post-exercise survey. 100% of participants agreed that the simulation improved the group's ability to manage a disaster. 90% agreed that the simulation was a valuable use of time; that they would encourage their colleagues to attend the simulation; and preferred the simulation to a didactic session. Median overall satisfaction score was 6.5 on a scale of 1 to 7. 80% of participants stated they would prefer a longer simulation session.

DISCUSSION: The present study suggests that during simulated disaster response requiring increased surge capacity, hospitals in low resource environments may perform relatively well in triage, bed assignment, and medical doctor assessment when compared to simulated disasters with adequate resource levels. However, in this study, there was a significant delay to disposition decision. Although the aetiology is not entirely clear, it may be that although physicians are comfortable triaging and managing patients with limited resources, they may still be uncomfortable making difficult treatment decisions such as disposition based on limited resources. Overall, the pilot project was very well received by the students and will likely be used as a standard tool for training health workers involved in disaster relief and humanitarian aid programs.