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Methodology for Developing Realistic Patient Scenarios for Research Applications

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14. ABSTRACT
Introduction: The U.S. Army Aeromedical Research Laboratory's Enroute Care Group (ECG) Research Team has performed several research studies that require participants to provide care to simulated patients during data collection. These simulated patients must mimic human anthropometry, display injuries realistically, provide dynamic vital signs, respond to treatment, etc. ECG has developed a methodology for creating these patient scenarios to meet these requirements. Materials and Methods: Patient requirements are determined during early development of the research protocol, such as casualty evacuation category (urgent surgical, urgent, priority, or routine) and number of patients needed in each category. This decision is made with the input of a subject matter expert (SME), such as a critical care flight paramedic or flight surgeon, to determine realistic patient configurations in the medical evacuation platform being used. A data request form with detailed patient parameters is submitted to the Joint Trauma System (JTS) Department of Defense Trauma Registry. After receiving de-identified patient records from the JTS registry, the SME down-selects the records, extracts the essential clinical information, then uses it as the basic structure for the simulated patients.

15. SUBJECT TERMS
methodology, patient simulation, critical care flight paramedics, CCFPs, medical evacuation, MEDEVAC, research, U.S. Army

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14. Abstract (continued)

The team then designs the scenarios (e.g., decompensation events, alarms, responses to interventions) using available technology that meets the study objectives and programs them into the patient simulator software. The treatment responses of the simulated patients are customized within the software for added realism. The simulated patients are dressed with moulage with the injury patterns from the JTS record summary, and tactical combat casualty care (TCCC) cards are created for each patient. Participants review the TCCC cards just prior to the start of data collection and begin treatment based on the TCCC information, injuries presented, and the live vital signs displayed on patient monitors. Treatments given during data collection are input into the simulator program by research team members remotely monitoring the scene so that patients respond to the treatments in real-time. Results: The results are realistic, customizable patient scenarios grounded in real-world events suitable for enroute care research and provider training. Conclusion: Over several studies, ECG has iteratively developed a method for customizing patient scenarios, allowing for realistic training during data collection.

Methodology for Developing Realistic Patient Scenarios for Research Applications

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Background

The U.S. Army Aeromedical Research Laboratory's (USAARL's) Enroute Care Group (ECG) Research Team has performed several research studies that require participants to provide care to simulated patients during data collection.

Simulated patients must mimic human anthropometry, display recognizable injuries, provide dynamic vital signs, and respond to treatments given.

ECG has iteratively developed a methodology for creating these patient scenarios for simulated medical evacuation (MEDEVAC) scenarios. These scenarios take advantage of the critical care flight paramedic's (CCFP's) familiarity with the patient simulators and monitoring equipment, which are the same as those used for their training and actual patient care, respectively.

Methods

1. Patient requirements are determined during early development of the research protocol to address the study's hypotheses.
   - Number of patients
   - Casualty evacuation categories (urgent surgical, urgent, priority, or routine)

Table 1. Example Patient Configuration for a Research Protocol

Overall Configuration #	Used for Participant (P) #	Assistance Level – # Patients (PT)	First Patient # U = Urgent	Second Patient # P = Priority	Third Patient # P = Priority
Configuration 1	P1,P5,P9,P13,…	Standard – 2PT	PT1 (U)	PT6 (P)	-
		T2R Assisted – 2PT	PT2 (U)	PT7 (P)	-
		T2R Assisted – 3PT	PT3 (U)	PT10 (P)	PT5 (P)
		Standard – 3PT	PT4 (U)	PT9 (P)	PT8 (P)
Configuration 2	P2,P6,P10,P14,…	T2R Assisted – 3PT	PT4 (U)	PT9 (P)	PT8 (P)
		Standard – 3PT	PT3 (U)	PT10 (P)	PT5 (P)
		Standard – 2PT	PT2 (U)	PT7 (P)	-
		T2R Assisted – 2PT	PT1 (U)	PT6 (P)	-
Configuration 3	P3,P7,P11,P15,…	T2R Assisted – 2PT	PT3 (U)	PT6 (P)	-
		Standard – 2PT	PT4 (U)	PT7 (P)	-
		Standard – 3PT	PT2 (U)	PT9 (P)	PT5 (P)
		T2R Assisted – 3PT	PT1 (U)	PT10 (P)	PT8 (P)
Configuration 4	P4,P8,P12,P16,…	Standard – 3PT	PT1 (U)	PT10 (P)	PT8 (P)
		T2R Assisted – 3PT	PT2 (U)	PT9 (P)	PT5 (P)
		T2R Assisted – 2PT	PT4 (U)	PT7 (P)	-
		Standard – 2PT	PT3 (U)	PT6 (P)	-

A MEDEVAC subject matter expert (SME), such as an experienced CCFP or flight surgeon, is heavily involved in scenario development to determine realistic patient configurations in the MEDEVAC platform used. The SME also creates a list of patient information needed for the data requested in Step 2.

2. A data request form with detailed patient parameters is submitted to the Joint Trauma System (JTS) Department of Defense Trauma Registry.

Methods Continued

3. After receiving de-identified patient records from the JTS registry:
   - Records are down-selected
   - SME extracts essential clinical information
   - SME creates patient summaries to serve as the basic structure for the simulated patients, including specific medical events to trigger alarms

4. The research team designs patient scenarios (e.g., decompensation events, alarm timing and limits) using the JTS summaries to meet study objectives.

5. For USAARL studies, the equipment used for patient simulation is as follows: computers with Laerdal Learning Application and VitalsBridge Connect, SimMan®3G manikins, VitalsBridge™ units, and Zoll Propaq® MD monitors (Figure 1). The patient simulator is the same as those used for CCFP training, and the monitor is part of the U.S. Army Medical Equipment Set.

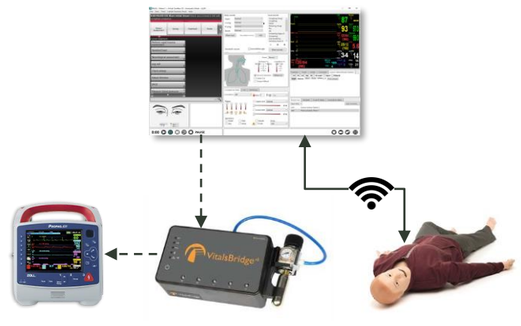

Figure 1. Patient simulation equipment.

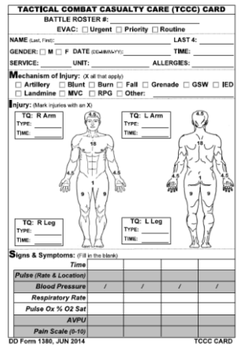

Figure 2. TCCC Card, front side.

6. The SME creates tactical combat casualty care (TCCC) cards for each patient (Figure 2).

7. The research team programs the patient profiles into the patient simulator software, along with likely treatments and medications available to participants for quick selection during data collection. Treatment responses are customized within the simulator software.

8. Patients are dressed with moulage (mock injuries) to match the JTS summaries. Moulage kits and detailed instructions are created for each patient to allow non-SMEs to moulage the manikins, though an SME verifies all preparations.

Participants review the TCCC cards just prior to data collection and begin treatment based on the TCCC information, moulage, patient simulator display, and the real-time vital signs displayed on the patient monitors.

Methods Continued

9. Treatments given during data collection are either detected by the patient simulator or input into the simulator program by research team members at a remote monitoring station. An SME is present during data collection to ensure patient response to intervention is realistic and timely.

The methodology for developing realistic patient scenarios is summarized as:

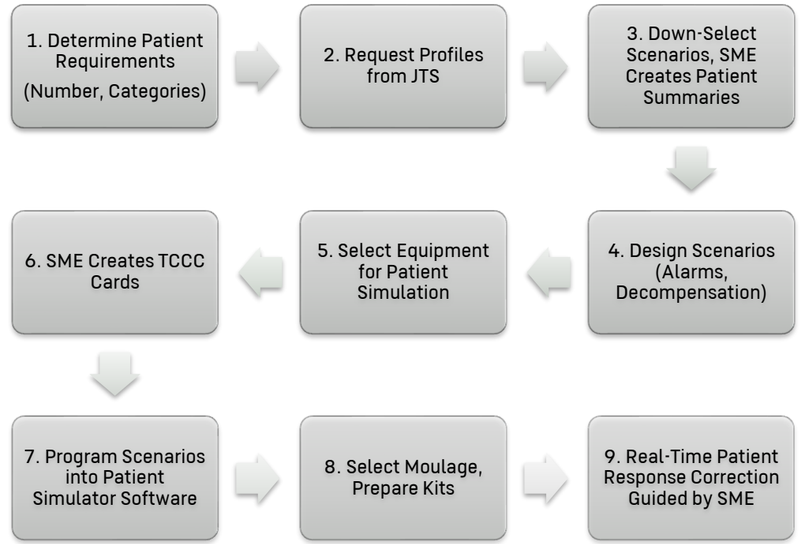

Figure 3. Summarized process for creating realistic patient scenarios.

Discussion

The most crucial component of developing realistic patient scenarios for research applications is consulting an experienced SME during all phases of development and having them present for data collection to ensure realistic patient responses.

Conclusion

This methodology results in patient scenarios that present realistic initial patient conditions, provide real-time vital signs using equipment that CCFPs are trained to use, present recognizable injury patterns, and react realistically to treatments given. These factors enhance immersion and allow for data collection focused on patient care.

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