# Acceptability and Preferences of Simulation-Based Continuing Education Among Emergency Medical Service Providers

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## ABSTRACT

**Introduction:** Simulation-based education (SBE) has been shown to be an effective and accepted teaching modality across multiple fields of medical education. Prehospital systems currently utilize simulation for initial training; however, few studies have determined the acceptability of simulation-based training for continuing education among emergency medical service (EMS) providers.

**Methods:** We performed a retrospective mixed method review of data from prehospital provider evaluations of high-fidelity SBE training sessions. Survey responses included questions on a Likert scale pertaining to acceptability of the training, as well as free-text comments. Providers included a mix of crews with varying levels of training.

**Results:** We received a 96% response rate for providers who completed the training. Participants rated simulation as an educational tool and the overall value of the session highly for EMS providers across all levels of training with no difference among training level. All providers also indicated they would like similar training on a frequent basis in the future.

**Conclusion:** Simulation-based education was found to be an acceptable tool for EMS training and should be considered for use during continuing education for all levels of practicing EMS providers. In addition, EMS providers indicated a preference for participating in SBE on a frequent basis. EMS training programs should consider incorporating more frequent SBE.

## INTRODUCTION

Medical education encompasses much more than teaching core material to learners. It is equally important for medical professionals to learn procedural skills, patient communication skills, and interprofessional communication. This multifaceted approach to medical education has led to the expansion of education techniques beyond traditional methods. One such method is simulation-based education (SBE), which is defined as any educational activity that utilizes simulation aids to replicate clinical scenarios.[1] Due to its ability to integrate multiple educational objectives into a single training method, SBE has become widely accepted within health care training.[2] This teaching method is integrated into the curriculum of numerous health care professional education programs, including medical schools, pharmacy schools, nursing schools, and residency physician training programs.[3-7] It is now used extensively in emergency medicine residency training programs to teach clinical knowledge and procedural skills, to reinforce the importance of communication, and for performance assessment.[6,8-12] Simulation has been shown to have multiple advantages over traditional teaching methods for emergency medicine physician training, including creating an active learning environment in a controlled setting while providing realistic patient encounters.[13-14] SBE has also traditionally been a part of the initial training of prehospital providers.[15-16]

Current practices in the United States for emergency medical technician training use SBE during primary paramedic training programs, which is supported in the National Registry for Emergency Medical Technician training requirements. Many accredited emergency medical services (EMS) training centers have access to SBE resources of varying degrees of complexity.[14] These high-fidelity simulations use visual and auditory cues in combination with dynamic patient conditions to replicate a realistic clinical patient encounter. As EMS providers also encounter critically ill patients, potential benefits for EMS provider education exist.[17]

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SBE also may offer the ability to increase the amount of learning opportunities for EMS providers in need of skill retention for low-frequency, high-acuity prehospital procedures and patient encounters as a tool for continuing education.[18] Recent studies also have suggested using simulation techniques for paramedic performance assessments.[19] In addition to its utility as an educational tool, SBE has been shown to lead to improved clinical outcomes when compared to lecture-focused curricula.[20] Continuing education is required of prehospital providers, with varying state and national requirements for each provider level. For example, Wisconsin paramedics must complete 48 hours of training over each 2-year period to renew their state certification.

A recent systematic review evaluating the use of SBE in nurse practitioner training suggested that in addition to enhancing clinical knowledge, SBE increases student satisfaction with their training when compared to traditional teaching methods.[21] Although SBE is used by many training centers in the initial training for providers at education centers, it has not been widely integrated into continuing education for providers across the United States. A recent study in the field of nursing education explored the utility of using simulation-based learning as a method of continuing training over consecutive years. These researchers found that annual simulation training resulted in increased participant satisfaction, as well as increased self-confidence in targeted training areas.[22] Few existing studies have evaluated the acceptability of continuing simulation education training and evaluation among EMS providers. Additionally, the acceptability of SBE among prehospital providers has not yet been established, and the optimal use of realistic patient simulation outside of the primary paramedic training program remains unknown.

In this study, we aimed to evaluate the acceptability of high-fidelity in situ simulation training among practicing EMS providers. Secondarily, we sought to compare the opinions and perceptions of SBE among various levels of EMS providers.

## METHODS

We performed a retrospective mixed method review of both qualitative and quantitative data from prehospital provider evaluations of high-fidelity SBE training sessions collected over a 2-year period from August 1, 2015, through July 31, 2017. Learners for the SBE training sessions included adult practicing providers at various levels of medical training, including emergency medical technician-basic (EMT-B), advanced emergency medical technician (AEMT), and emergency medical technician-paramedic (EMT-P) providers. The SBE sessions were held as part of the scheduled continuing education training program for licensed EMS providers within the Dane County, Wisconsin EMS system, consisting of 23 transporting 911 EMS agencies. There was a mix of urban, suburban, and rural agencies, as well as a mix of basic life support, AEMT, and advanced life support EMS crews. Training sessions were conducted by a consistent group of emergency medicine and EMS physicians using a portable high-fidelity programmable patient simulator (Simulaids SMART STAT Basic, Nasco). This high-fidelity simulation was purchased by the county EMS office to be shared across all EMS agencies. All educators were experienced instructors and familiar with SBE best practices. Each training session lasted 1 hour for each crew of 2 to 3 EMS providers and included a prebriefed introduction, case-based scenario, and debriefing component. The patient scenarios for each training group were chosen from a pool of 5 cases developed specifically for EMS training sessions by a physician with extensive training and expertise in simulation instruction and case development. Scenarios included a patient with atrial fibrillation with rapid ventricular response (RVR) in the setting of sepsis, a patient with a severe asthma exacerbation, a patient fall with head injury, a motor vehicle collision involving a traumatic amputation, and a patient with angioedema. Each case had predetermined learning objectives and critical interventions appropriate to the training level of the EMS providers.

Simulation parameters were set to realistically represent each clinical case. For instance, in the case of a patient with symptomatic atrial fibrillation with RVR in the setting of sepsis, the portable patient simulator was programmed with parameters to replicate vitals and clinical findings consistent with a patient with these conditions. The simulator was transported by the instructor to the location chosen by the EMS agency for which the training was taking place—usually their EMS station. The simulator was placed on an EMS cot in the agency's own ambulance to enable an in situ simulation. EMS crews worked in small groups of 2 to 3 during simulated patient care, reflecting their usual ambulance staffing model. Learners used the agency's ambulance and training supplies, such as equipment and medications, for the training session to maintain as high-fidelity training as possible. Training sessions were designed to incorporate previously established simulation education best practices as described by Issenberg et al.[13]

Training sessions included a 30-minute simulated case followed by a 30-minute debrief. The debrief session was used to provide a summary of the case, a discussion of approach to the patient, pathophysiology of disease, mechanisms of interventions, and a review of the critical actions expected for appropriate patient care. This approach allowed learners to engage in discussion regarding clinical care and medical training topics, while also allowing time for providers to have their questions answered. Immediately after every training session, each participating provider was asked to voluntarily fill out a paper evaluation survey. The survey asked the learners their opinions and perceptions of SBE as a training tool, as well as the overall quality of the training session. A question assessing how often providers would like to receive similar SBE training in the future was added to the survey later in the study. In addition, the survey included a free-text section for comments on "what you liked" and "areas for improvement." A Likert scale ranging from 1

(very poor) through 5 (very good) was used, and suggested frequency of future SBE training responses included never, quarterly, bimonthly, monthly, biweekly, weekly, and biannually.

Data were deidentified and aggregated for analysis. Demographic characteristics were captured, including provider training level. The primary outcomes of interest were the ratings for "simulation as an educational tool" and "overall value of this session." Comparisons between the 3 groups (EMT-B, AEMT, EMT-P) were then measured using analysis of variance.

## RESULTS

During the 2-year period, we received a total of 268 completed evaluations from the 279 providers who completed the training—a 96% response rate. Of the survey responses, 58 (21.6%) were EMT-B, 33 (12.3%) AEMT, and 177 (66.1%) EMT-P.

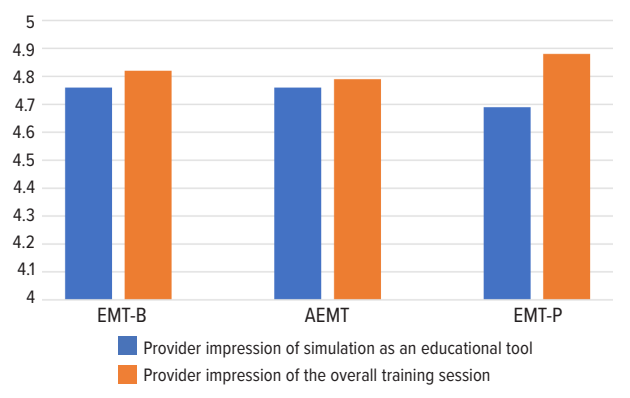
Participants rated simulation as an educational tool 4.76 (SD 0.47), 4.76 (SD 0.49), and 4.69 (SD 0.57) for EMT-B, AEMT, and EMT-P providers, respectively ($P = 0.605$) Similarly, participants rated the overall value of the session 4.82 (SD 0.39), 4.79 (SD 0.41), and 4.88 (SD 0.37) for EMT-B, AEMT, and EMT-P providers, respectively ($P = 0.330$). See Figure 1.

A total of 73 providers also were asked to determine how often they would like these training sessions in the future. Responses consisted of "never" (n = 0, 0.0%), "quarterly" (n = 24, 32.8%), "bimonthly" (n = 11, 15.0%), "monthly" (n = 33, 45.2%), "biweekly" (n = 5, 6.8%), "weekly" (n = 1, 1.4%), and "biannually" (n = 1, 1.4%) (Figure 2).

In addition to the questions stated above, free-text comments for SBE training strengths and weaknesses were analyzed for general themes. Representative comments are included in the Table.

Several themes were identified for what providers specifically liked about the SBE training, including the realistic nature of the simulation training, the location of the training within the ambulance setting, and the utility of the debriefing session immediately following the case scenarios for further discussion. Providers also consistently commented favorably regarding the ability to perform hands-on skills. In fact, this was also noted to be a theme for the area of improvement given the many comments suggesting adding more hands-on and procedural skills to the case scenarios.

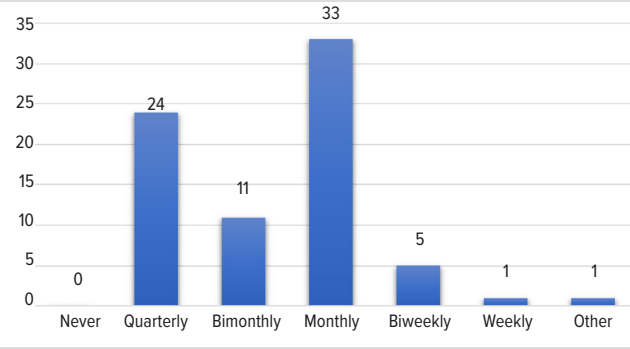
**Figure 1.** Provider Responses to Acceptability of Simulation-Based Continuing Education




Responses based on 5-point Likert scale.

Abbreviations: EMT-B, emergency medical technician-basic; AEMT, advanced emergency medical technician; EMT-P, emergency medical technician-paramedic.

**Figure 2.** Survey Response to Emergency Medical Services Providers' Preferences for Future Simulation-Based Education Training Sessions




## DISCUSSION

In this US-based study, EMS providers of all levels reported positive experiences with SBE. Across all levels of training, SBE was rated very highly by trainees in response to "simulation as an educational tool" and "overall value of this session." When assessed on a Likert scale, the average response rates for the use of simulation as an education tool and overall response to the SBE training session were strongly positive, with no statistically significant difference between the level of providers surveyed. This suggests that the utility of SBE training may be accepted among a wide variety of EMS professionals, regardless of their current training level. Providers at all levels also responded that they would like to have similar simulation training sessions on a regular basis; 98.6% said they would like these sessions at least quarterly. The most popular response (45%) was to have simulation training monthly. This suggests that not only did EMS providers of all levels rate SBE highly, but they would also prefer to participate in SBE on a more frequent basis.

Several specific themes were identified from the survey's free-text comment section for both what providers felt were positive attributes of SBE and suggestions for improvement. Within the positive comments, identifiable themes included the hands-on nature of the simulation, the location of the field training within the prehospital setting, and a positive reaction to the debriefing session following the scenarios. These themes are based on responses such as, "nice to be in our environment (ambulance)," "liked it in the medic unit," "real-life situation…. finally," and "good Q&A; good discussion." There was also an identifiable theme for areas of improvement. Providers consistently stated that they would like future SBE training sessions to incorporate even more proce-

**Table.** Representative Free-Text Survey Responses of Strengths and Weaknesses of Simulation-Based Education Training Sessions Used to Generate Identifiable Themes

| Comments on Strengths | Comments on Areas for Improvement |
|---|---|
| • "Liked it in the medic unit" | • "More hands-on with skills" |
| • "Good Q&A, good discussion, nice to be in our environment (ambulance)" | • "Would be nice to use equipment on patient, ie, blood pressure cuffs, IVs, etc" |
| • "Great discussion afterwards" | • "Incorporate crew actions and note-taking" |
| • "Dynamic changes to sim man based on treatments" | • "Hands-on" |
| • "Hands-on sim man. Talking after the call. Reasoning" | • "More skills" |
| • "Real-life situation.... finally" | • "Actual drawing up meds and pushing" |
| • "Back of rig, real training" | • "Actual radio reports" |
| • "Nice to be in our environment (ambulance)" | • "More hands-on with complicated procedures" |
| • "Continuous challenges and real-life results" | |

Abbreviation: sim man, simulation mannequin.

dural skills. Specific comments included, "more hands-on skills," "would be nice to use more equipment (IVs, blood pressure cuff, etc)," and "actually drawing up meds and pushing, even if into IV arm." In general, the free-text feedback was positive and reflected the high provider ratings given to the SBE sessions. The feedback regarding areas of improvement is useful to further understand how these trainings can improve to generate even greater provider satisfaction in the future.

Our findings are consistent with previous findings suggesting benefit for other health care professional fields, mainly in hospital or professional school settings. Continuing medical education places an increased emphasis on interprofessional communication and teamwork within practicing provider and existing care teams. It has been suggested that to build high quality care teams, teams should learn and train together.[13] For this reason, SBE could be a very efficacious tool in the continuing education of prehospital care teams, allowing them to work on communication skills, medical knowledge, and procedural skills in an educational setting that forces teamwork within a care team unit while simultaneously producing high levels of student satisfaction with their training.

Based on our results, as well as the results of previous studies, we believe there is potential to enhance the level of SBE used for EMS provider continuing education. Specifically, there exists an opportunity to augment the current practices for continuing education of EMS providers, which currently are heavily focused on lecture-based education models for many EMS systems and medical directors. It is our belief that SBE should be included and encouraged as a training modality for continuing education of EMS providers. The optimal simulation training interval may vary based on the location of EMS services and their annual call volume. It is likely that more frequent training would further benefit providers who are exposed to less call volume and severity throughout the year. Based on the survey responses, we would recommend a continued simulation interval between monthly and quarterly. A consistent interval of SBE may offer significant benefits for providers if integrated in a structured fashion into EMS continuing education.

We believe our experience establishing a county-based simulation training program following a continuing education model of EMS providers was feasible and reproducible. To achieve the same level of success, we would recommend the development of reproducible simulation cases, a patient simulator, training supplies, and educational materials. Immediately following the hands-on simulation component, simulation sessions should include a debriefing session by the instructor. In our experience, having a physician instructor for the debrief discussion was beneficial for the small groups. However, we recognize that EMS instructors at various other levels could potentially be utilized as lead simulation instructors, as this may be more practical for some EMS systems.

### Limitations

Our study has several limitations. First, there is no control group against which to compare the Likert survey responses from the SBE participants. Also, our survey was a customized questionnaire that has not been validated previously to assess the acceptability and preferences of simulation. This study was conducted in a medium-sized Midwest city, which may not reflect the practice and training environment of other EMS systems. While high-fidelity simulations are preferred, not all EMS systems have access to them due to cost. However, this may be attenuated by larger collectives jointly purchasing simulation equipment or renting equipment from a local simulation center. If these options are still unobtainable, low-fidelity simulation is reasonably obtainable by most EMS systems and would suffice. However, this study did not evaluate the preferences of EMS providers using low-fidelity simulation, and their acceptability is being inferred.

We did not include emergency first responder learners in this study and did not differentiate between career providers and volunteers or differentiate providers by their years of experience. Frequency of training was added to the survey midway through the study and only captured a subset of the providers who evaluated SBE as an educational tool. Notably, we did not assess patient-level outcomes following the simulation training. Further studies may be required to better account for the above limitations.

## CONCLUSION

Simulation-based education was received positively by EMS providers, without significant differences in acceptability among the various levels of providers, including EMT-B, AEMT, and EMT-P. Simulation education was found to be an acceptable tool for EMS training and should be considered for use during continuing

education for all levels of practicing EMS providers. In addition, EMS providers indicated a preference for participating in SBE on a frequent basis. EMS training programs should consider incorporating more frequent SBE. Further studies are needed to rigorously evaluate the effectiveness of this teaching method for EMS providers.

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