

# OUTCOMES OF A SIMPLIFIED ULTRASOUND-GUIDED INTRAVENOUS TRAINING COURSE FOR EMERGENCY NURSES

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## Contribution to Emergency Nursing Practice

- This research evaluates the outcomes of an ultrasound-guided intravenous (USGIV) training program for newly trained emergency nurses on an emergency department's ability to deliver cost-effective and efficacious care by reducing attempts at IV access in the emergency department.
- A simplified and economical USGIV program is described, and potential rates of completion and nurses most likely to succeed are identified.
- USGIV placement is a skill that can be mastered by emergency nurses of all skill levels, including novice emergency nurses.

## Abstract

**Introduction:** Various medical or anatomical conditions can lead to difficult intravenous access (DIVA) in the emergency department. It was hypothesized that developing an emergency nurse-training program could reduce IV attempts in the emergency department, improving throughput and patient care.

**Methods:** Emergency nurses completed a 4-hour ultrasound-guided intravenous (USGIV) access course and achieved competency after 10 successful supervised USGIV insertions on patients. Data were collected from a nurse-completed USGIV log and the electronic medical record. Experience levels, rates of completion, rates of success, and the effects on attempts of IV access were analyzed.

**Results:** Thirty-four emergency nurses enrolled in the study over 9 months, and 12 (35%) developed competency. Successful cannulation rates improved from 81% for procedure attempts 1 to 10, to 96% for attempts 21 to 30. Overall IV attempts by nurses and physicians ( $n = 24,471$ ) decreased by 2%,  $P = 0.013$ . DIVA IV attempts ( $n = 1,366$ ) decreased by 7%,  $P = 0.003$ .

**Discussion:** USGIV training programs can decrease total number of IV attempts. A simplified and economical USGIV training program for emergency nurses can be successful and may be dependent on emergency nurse experience levels and initiative.

**Key Words:** Ultrasound-guided intravenous; Outcomes; Intravenous attempts; Competency; Economical; Difficult intravenous access

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Difficult intravenous access (DIVA) is a pervasive problem, affecting 15% to 26% of ED patients.<sup>1-3</sup> Medical conditions—such as diabetes, IV drug abuse, and sickle cell disease, in addition to anatomic characteristics such as small vein diameter and poorly visualized or palpated veins—all contribute to DIVA.<sup>2,4</sup>

Patients with DIVA pose unique problems to emergency departments and the clinicians taking care of them. Difficult IV insertions can take twice as long as regular IV insertions to obtain, with 30% taking more than 15 minutes and more challenging IV insertions taking 2 hours to establish.<sup>1,5</sup> Patients with DIVA often have longer lengths of stay in the emergency department, use additional resources, and significantly affect patient throughput to a definitive level of care.<sup>1,6</sup> Patients experience delays in

administration of medication and laboratory evaluation while IV access is postponed because of difficult access.<sup>7</sup> In addition, because IV access is a painful procedure, multiple and difficult attempts at IV access increase the number and duration of painful experiences for ED patients, ultimately degrading their quality of care.<sup>8,9</sup>

In an effort to reduce not only the amount of nursing time spent on IV placement but also the negative impact multiple IV attempts have on patients, clinicians and care centers are exploring different approaches to obtaining vascular access in patients with DIVA. One of the most popular, successful, and highly recommended approaches is the use of bedside ultrasound to guide peripheral intravenous insertion: ultrasound-guided intravenous (USGIV) access.<sup>10–12</sup>

USGIV access has been used in clinical practice for more than 30 years, with a high rate of success among trained users.<sup>13</sup> Studies have found an 87% to 95% rate of success for USGIV access in patients with DIVA, and these studies demonstrate that USGIV access is both quicker and more accurate than standard IV administration for these patients.<sup>1,14,15</sup> USGIV access has also been shown to reduce the need for invasive central venous access.<sup>16,17</sup> The downstream effects of USGIV access are measurable, effectively reducing patient wait times, complications, and costs, while increasing patient satisfaction and nursing efficiency.<sup>10,15,18–20</sup>

USGIV training programs have varied enrollment and training experiences. Several programs limited USGIV access to experienced nurses or nurses with histories of proficient IV skills.<sup>10,14,15,17,21</sup> However, studies have demonstrated that novices from a variety of training backgrounds can be successful, if not more successful, with USGIV placement over standard IV initiation.<sup>18,22,23</sup> Some programs have intensive training regimens that can last 3 full days.<sup>15,21,24</sup> Other studies assessing USGIV training programs were challenged with small sample sizes of patients and/or participants.<sup>10,17,22</sup> In addition, few studies explored the outcomes of newly trained emergency nurses and how this skill set affected the delivery of effective care.<sup>10,23,24</sup>

The purposes of this study were to implement a low-cost USGIV training program for emergency nurses that would require a 4-hour time commitment and to examine the impact of this program on peripheral IV starts. The effects of this simplified training program on the rate of success of IV placement and acquisition of competency were explored. As previous studies have focused on more experienced nurses, this study also compared both the interest and completion rate of emergency nurses from a variety of experience levels.

## Methods

The study design was a quality improvement (QI) project and prospective single arm pre- and poststudy following Rogers' 2003 "Diffusion of Innovations" theoretical framework.<sup>25</sup> The study was conducted at an urban academic, primarily adult, emergency department and level 1 trauma center, with more than 86,000 visits a year and that hosts a 4-year emergency medicine residency program with more than 55 residents. This emergency department spans over 2 levels and has 2 trauma bays, 45 acute-care beds, with an additional 15 flex-care spaces, and 21 split-flow treatment areas. Before the study, USGIV access lines were placed by residents, attending physicians, and 2 emergency nurses that had already been trained in USGIV access.

This study was reviewed and approved by the hospital's Nursing Research and Evidence-Based Practice Committee and Institutional Review Board. Beginning April 30, 2015, all full-time, part-time and per diem RNs in the emergency department were offered the opportunity to participate voluntarily in a USGIV course. The participants were not paid for the attending the course, but they were offered 4.8 continuing education credits, approved by the American Nurses Credentialing Center, for the 4-hour class and an additional hour of practice time. Thirty-four of approximately 130 eligible participants volunteered to participate in this project and signed written consent at the start of class. Two ED nurses who had been placing USGIV lines before the training intervention were not required to attend the class and did not participate in this study.

Emergency medicine residents who were members of the ED Ultrasound Committee volunteered to teach a 4-hour didactic and hands-on USGIV course. The course included a 10-question pretest assessing knowledge of basic ultrasound use, USGIV indications, complications, and procedural steps. Participants then viewed a PowerPoint presentation that described USGIV indications and ultrasound basics such as probe selection and orientation; vein, artery and nerve identification; target vein selection; skin preparation; and vein cannulation under ultrasound guidance. Participants were also provided with the opportunity to attempt 2 to 3 supervised USGIV placements on a vascular-access training model, along with the option of practicing on other classmates. Upon completion of the course, participants took a post-test consisting of the same questions as the pretest.

After completing the training, emergency nurse participants were required to have 10 successful USGIV attempts supervised by a trained USGIV nurse or physician. Other USGIV training programs have shown that

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