Outcomes of a Continuing Education Course on Intravenous Catheter Insertion for Experienced Registered Nurses

Margaret G. Lyons, MSN, CRNI, and Jennifer Kasker, MSN, RN, PCCN

Abstract

Many experienced nurses report a lack of confidence in their intravenous (IV) catheter skills despite training with a phlebotomist and designated orientation time with the IV team. This study assessed the success of an IV catheter insertion continuing education class aimed at improving experienced nurses’ skills levels, confidence, and knowledge regarding IV catheter insertion, maintenance, and infection prevention. Through a partnership between a hospital and a college of nursing continuing education program, a 1-day course was provided for 33 experienced nurses. The educators sought to determine whether a continuing education course improved the knowledge and skills of experienced nurses regarding the insertion of peripheral IV catheters and whether the nurses retained the knowledge and skills learned in a formal IV course over time. The findings showed that the continuing education IV course improved the knowledge and skills of experienced nurses. Improvement in knowledge was shown immediately after the course and 8 to 12 weeks later. Skills improvement with regard to infection prevention and policy adherence was evident. Because confidence data were collected with two different scales before and after the course, they were unusable for statistical testing. Further study is needed to determine whether nurses’ confidence levels would improve after the implementation of a formal IV course. Replication studies are also needed to validate the results with a larger sample size.

Nursing staff have variations in IV insertion training and certification levels (daSilva et al., 2010). Most undergraduate nursing programs do not provide instruction in IV insertion (Engum, Jeffries, & Fisher, 2003). Engum et al. (2003) reported that fewer than 50% of student nurses have any exposure to IV insertion before graduation. Hospitals provide limited time during orientation for nurses to observe this skill from an IV team member or preceptor. After a few supervised insertions, the nurse is expected to insert peripheral IV lines competently and proficiently. Nurses have found this training method unsatisfactory, and they report both increased stress levels among nurses and poor patient results (Aziz, 2009).

Adult learning principles are based on four assumptions: (1) adults are self-directed; (2) they learn through experience; (3) they use a problem-solving approach; and (4) they must perceive what they are learning as relevant and useful (Knowles, 1970). For nurses (adults) to make changes to their practice as a result of continuing education, these principles must provide the foundation for learning experience. Professional continuing education is designed to enhance the learner’s ability to provide comprehensive patient care (Bell, Pestka, & Forsyth, 2007). Engaging experienced nurses with multiple teaching methods (didactic, demonstration, and simulation) enhances learning, which can result in improved patient satisfaction and outcomes.

**APPROACH**

A continuing education program on IV line insertion was designed to enhance the knowledge, skills, and confidence levels of a group of experienced nurses. In constructing this course, educators asked the following questions:

1. Does a continuing education course improve the knowledge and skills of experienced nurses regarding the insertion of peripheral IV catheters?
2. Do nurses retain the knowledge and skills learned in a formal IV course over time?

To answer these questions, the educators used mixed methods (pretest-posttest), but primarily a one-way repeated measures design over time (Portney & Watkins, 2009). A one-way repeated measures study is used when effects of an intervention (continuing education course) on specific variables (knowledge, skills, and confidence levels of nurses related to IV insertion) are manifested over time (Portney & Watkins, 2009). Measures included pre-course test results, immediate post-course test results, and data collected 8 to 12 weeks after course testing. Knowledge was defined as information necessary for the insertion and care of peripheral IV catheters. Skill was defined as the ability to insert a peripheral IV line using aseptic technique, according to the Infusion Nurses Society competency guidelines (Infusion Nurses Society, 2006b). Successful placement included positive blood return, patency, and securement of the device. Confidence was defined by participants as a personal comfort level related to the ability to complete the task of IV insertion successfully.

This study was approved by the institutional review boards of a general hospital and a university.

Demographic data were collected, including length of time the nurse had practiced, type of unit in which the nurse currently worked, shift the nurse worked, previous IV education courses, and perceived experience level.

**MEASUREMENT METHODS**

Standards used to evaluate nurses’ skills were adapted from the Infusion Nurses Society core competency measures (Infusion Nurses Society, 2006a). Evaluation criteria are described in Sidebar 1.

Nurses in the study represented different educational levels, diverse units, different shifts, and varying years of practice. Before the class, participants were administered a pretest to assess knowledge of IV-related information (Sidebar 2). Questions were derived from the course. At the end of the class, the same test was given as the posttest. Key skills were observed by the educators with the use of a checklist adapted from the Infusion Nurses Society IV insertion competency guidelines (Infusion Nurses Society, 2006b). The checklist was tested for interrater reliability by the educators and found to be reliable (> 90% accuracy between educators). IV course participants were assessed for perceived confidence and success rates with the insertion of peripheral IV catheters. Participants were asked to participate in another posttest and skills validation evaluation 8 to 12 weeks after the class.
The continuing education program was a 1-day course that included didactic instruction and IV insertion skills/competency validation. The didactic portion of the class included review of venous anatomy and physiology, risks and complications associated with IV insertion, legal considerations, and documentation of peripheral IV insertion. It ended with competency validation for all participants. Participants were given time to practice IV insertion on a computer simulation haptic device and on mannequins. Competency validation was performed on a lifelike mannequin. The course was taught by an instructor who maintains certification in infusion therapy, works per diem for an infusion service, and routinely teaches IV certification classes. Forty nurses participated in the course and were divided into two separate classes. Seven of the participants were unavailable for posttesting and skills validation at the 8- to 12-week post-course interval.

**Setting and Sample**

Volunteer nurses from a Magnet® facility in suburban Philadelphia, Pennsylvania, participated in these classes. Nurses who had recently (< 1 year) taken a formal IV certification course were excluded from participation. Because of the intensity of the program, enrollment for each session was limited to 20 participants. The educators were responsible for data collection and competency validation. The number of participants was small, all worked at a single institution, and the study was limited to nurses who enrolled in the courses.

**Data Collection**

Demographic data and pretest and posttest data were collected using a Turning Point Technologies® automated participant response system (clickers). This system automatically calculated and tabulated responses into charts and Excel® spreadsheet. Responses were anonymous, but information was linked to each participant with a unique code on the response system. Demographic data were designed to identify participants’ length and type of experience and IV-specific experience. The pretest was administered at the beginning of
the course. The first posttest was administered at the conclusion of the class. The 10-item test related directly to the course objectives, venous anatomy and physiology, venous site and device selection, and infection prevention practices. Data were entered into a SAS system. Confidence and baseline IV success rates were obtained via Likert-type scales during pre-course demographic data collection. Skills data were collected using an adaptation of the Infusion Nurses Society competency validation checklist (Sidebar 3). Skills data were collected before and after the continuing education program and again 8 to 12 weeks after the course.

Outcomes

The test was used to compare pretest and posttest mean scores (Fig. 1). Skill competencies were scored 1 if they were performed and 2 if they were not performed. The test comparisons were used to measure specific skills improvement from the beginning of the course to the end of the course and at 8 to 12 weeks after the course (Fig. 2).

RESULTS

Knowledge Data

The average score was 77.88 pretest and 96.67 posttest, for an increase of 18.79 ($p < .0001$). The 8- to 12-week posttest average score was 90.38 ($p = .0018$). The dropoff was statistically significant, but knowledge was retained over time (90.38 vs. 77.88).

Skills Data

Data for skills checklist (SC) criteria 1 through 11 (Sidebar 3) were entered into the SAS software and tests were performed. SC1, SC2, SC3, SC4, SC6, SC7, SC10, and SC11 showed highly significant improvements. SC5, SC8, SC9, and SC12 showed nonsignificant changes; however, the means were very close to 1 at baseline, so there was no room for improvement. Only SC13 and SC14 had scores close to 3. It is possible that the participants believed that the questions were not applicable.

Confidence Data

Data before and after the course were collected with two different scales (Likert and visual analogue scale) and therefore were unusable for statistical testing. The 8- to 12-week washout period should help with testing effects, but was needed to determine whether the intervention information (knowledge) was retained over time. The washout period does not account for any outside influences that can affect results.

After completion of the peripheral IV certification course, nurse participants reported statistically signifi-
cant increased knowledge and skills levels with inser-
tion and adherence to infection prevention practices.
IV-related knowledge improved immediately after a
continuing education course and again 8 to 12 weeks
later. Significant $p$ values were associated with skills
improvement with regard to infection prevention and
policy adherence. The formal continuing education
IV course improved the knowledge and skills of expe-
rienced nurses. Knowledge was retained. Follow-up
evaluation at 8 to 12 weeks showed decreased test scores
compared with immediate posttest results (96.67% vs.
90.38%). The data showed that most of the knowledge
was retained at 8 to 12 weeks, as shown by a pretest
average score of 77.88 and an 8- to 12-week test average
score of 90.38. Replication studies are needed to vali-
date the results with a larger sample size.

CONCLUSION

Experienced nurses can be taught new skills. In this
study, multimethod teaching strategies were shown to
enhance adult learning and can help to close the theory-
practice gap. Although further study is needed, programs
such as the course described in this article meet the Insti-
tute of Medicine (2010) Future of Nursing recommenda-
tions for nurses to engage in lifelong competency-based
learning.

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key points

Intravenous Catheter Insertion
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1. Peripheral intravenous catheter insertion is a skill that can be en-
hanced using simulation and education for experienced nurses.

2. Peripheral intravenous catheter insertion should be included in
continuing education or staff development initiatives to reduce a
documented theory-practice gap.

3. Adult learning principles should be applied to educational
efforts undertaken to improve nursing knowledge and skill
sets.