EDUCATION

Randomized trial of high- and low-fidelity simulation to teach intrauterine contraception placement

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BACKGROUND: High-fidelity simulation creates conditions that resemble real circumstances, and can help teach procedures such as intrauterine contraception placement. Its impact on skill retention has not been studied.

OBJECTIVE: We sought to evaluate novice learners' skills, attitudes, and knowledge on placement of intrauterine contraception when trained using a high-fidelity commercially available simulator compared with a low-fidelity simulator.

STUDY DESIGN: We recruited senior nurse practitioner students and interns in obstetrics and gynecology and family medicine inexperienced with intrauterine contraception placement. In this unblinded, randomized controlled trial, participants were assigned to practice within a high-fidelity simulator group or a coasterlike model group. We evaluated intrauterine contraception placement skills, self-perceived comfort and competence, and knowledge before and after simulation, as well as at 3 months. Our primary outcome was the change in scores for intrauterine contraception placement skills before and after practice. Assuming a standard deviation of 15 points, we needed 10 participants per group to detect a 20-point difference in scores with 80% power.

RESULTS: From June through July 2014, 60 participants enrolled; 59 completed the initial study visit and 1 withdrew. In all, 48 (80%) completed the second study visit at 3 months. Demographic characteristics were similar for the randomization groups. We observed an improvement in intrauterine contraception placement skills for both groups following practice on simulators ($P < .01$); the proportion that improved was similar (20% for the high-fidelity simulator group and 15% for the coaster group, $P = .55$). Increases in self-perceived comfort and competence with placing copper, levonorgestrel 52-mg, and levonorgestrel 13.5-mg devices were similar (all $P \geq .11$). Knowledge assessment scores were comparable between the 2 groups postsimulation (73% for the high-fidelity simulator group and 80% for the coaster group, $P = .29$) and at 3 months (87% for both groups, $P = 1.0$).

CONCLUSION: Trainees' knowledge, intrauterine contraception placement skills, and self-perceived comfort and competence were comparable whether they used high- or low-fidelity simulators.

Key words: contraception, education, intrauterine device, simulation training

Introduction

Intrauterine contraception (IUC) is highly effective, long-acting, and reversible. Over the past decade, its use among contracepting women of reproductive age has increased from about 2% to almost 12%.[1-3] More widespread use of long-acting reversible contraception likely has contributed to the recent decline in unintended pregnancy rates in the United States.[4]

To make IUC widely available to women who desire long-acting reversible contraception, it is important to train physicians, nurse practitioners, certified nurse midwives, and physician assistants in counseling and appropriate placement techniques.[5,6] An evidence-based framework for teaching procedural skills supports a "learn, see, practice, prove, do, and maintain" approach in which trainees first acquire cognitive knowledge, usually from a didactic component (learn), and then observe a procedure (see).[7] They gain psychomotor skills from deliberate practice, usually on a simulator (practice), until they demonstrate readiness to perform the procedure on a patient (prove). Trainees perform a procedure under supervision until they can be entrusted to do so independently (do). Ongoing practice (maintain) is important, as skills can degrade quickly, particularly for novices.[7]

Medical educators use high-fidelity models for teaching in obstetrics and gynecology,[8,9] but these models have not been studied for IUC training. Simulation methods allow trainees to have hands-on practice doing procedures in a low-stakes setting prior to caring for patients. Simulation can improve skills and reduce anxiety among learners.[10-12] However, little published research compares high-fidelity simulator (HFS) models vs low-fidelity simulation models and their impact on knowledge, skills, or attitudes.

Our study focused on the "learn," "practice," and "prove" elements of the framework for teaching procedural skills. We conducted a randomized controlled trial to compare novice learners' knowledge, skills, and self-reported comfort and competence with IUC placement when trained using a HFS vs low-fidelity simulator. We hypothesized that participants trained with the HFS would more consistently perform the steps of IUC placement correctly and have higher self-perceived comfort and competence with IUC placement, both immediately following practice on their assigned simulator as well as 3 months later.

Materials and Methods

The Beth Israel Deaconess Medical Center Institutional Review Board approved this study. Registration in a public trials registry was not required as

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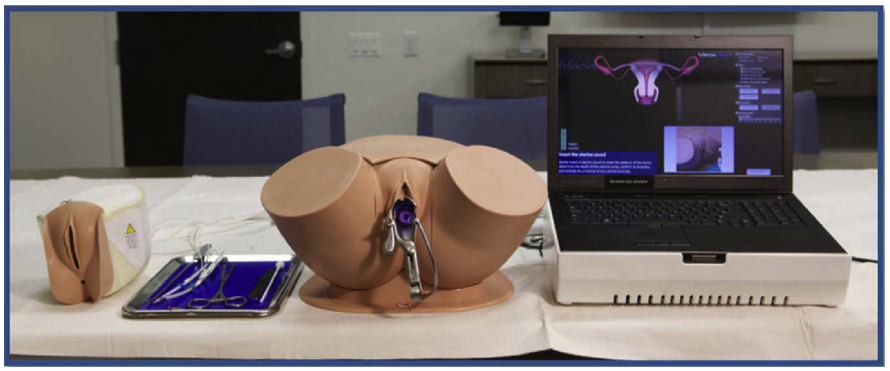
FIGURE 1
High-fidelity simulator



High-fidelity model consisting of pelvis and attached laptop computer, which provides audible feedback and visual depiction of intrauterine contraceptive device as it is placed into uterus. Photograph courtesy of Affiliates Risk Management Services Inc.

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FIGURE 2
Low-fidelity simulator

Low-fidelity model consisting of flat model uterus into which learners can place intrauterine contraception.

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this study represented an educational intervention that did not have a health outcome. For transparency, however, it is registered on clinicaltrials.gov (NCT02220205). We followed the 2010 Consolidated Standards of Reporting Trials in describing this study. We recruited senior nurse practitioner students, interns in family medicine, and interns in obstetrics and gynecology by e-mailing the program directors of their respective training programs. Trainees who were inexperienced with IUC placement and who intended to provide IUC in their future practice were eligible. Because there is no generally accepted definition of "novice" provider, we determined by consensus among members of our research team that this term would refer to individuals who reported having placed <5 intrauterine devices.

For the HFS, we used the PelvicSim (VirtaMed, Zürich, Switzerland). The device (Figure 1) consists of a model pelvis with built-in sensors that provide haptic feedback. It is connected to a laptop computer, which contains software that guides the user with audio and visual feedback through a variety of gynecologic procedures, including IUC placement. A complete description has been published elsewhere.[13] We used coasterlike models (Bayer HealthCare Pharmaceuticals, Whippany, NJ) as the low-fidelity simulator (Figure 2).

We randomly assigned participants to practice within either the HFS or coaster group in a 1:1 ratio using computer-generated blocks stratified by trainee background (nurse practitioner student vs intern). A research assistant with no involvement in this study prepared sequentially numbered opaque envelopes designating simulator assignment, as well as the order in which the 3 types of IUC (copper T380A [ParaGard; Teva Pharmaceuticals, North Wales, PA] [Cu-IUC]; levonorgestrel [LNG] 52 mg [Mirena; Bayer HealthCare Pharmaceuticals]; and LNG 13.5 mg [Skyla; Bayer HealthCare Pharmaceuticals]) were to be placed at each of 3 evaluation points (before simulation, after simulation, and at 3 months). The participant opened each envelope at the time of enrollment.

We asked participants to complete 2 study visits: 1 at the time of enrollment and a second visit approximately 3 months later (Figure 3). They received $100 for completing the first study visit and $50 for the second. The initial study visit took place in either the simulation center at Beth Israel Deaconess Medical Center or in the department of obstetrics and gynecology administrative offices, and all follow-up visits took place in the latter location. At the initial study visit, participants completed a 15-item, multiple-choice quiz to assess their baseline knowledge about IUC eligibility criteria, mechanisms of action, and patient counseling. They used a desktop computer to view a didactic module consisting of static slides, which reviewed IUC effectiveness, mechanisms of action, side-effect profiles, patient eligibility criteria, and insertion timing. They then completed a postdidactic knowledge test. Participants also completed a baseline attitudes assessment in which they rated their comfort with IUC placement using a modified Likert scale and their self-perceived competence using the following options: "not at all competent," "I can do it if a preceptor talks me through it," "I can do it with minimal hands-on help from a preceptor," "I can do it with a preceptor available for backup in the room with me," or "I can do it; the preceptor doesn't have to be in the room."

During the initial visit, all participants viewed an insertion tutorial video for each IUC device type. Following the tutorial, they were filmed placing a speculum, sounding the uterus, and performing 9 insertions (3 of each type of device) on a desktop pelvic model (S502 family planning simulator; Gaumard Scientific, Miami, FL). Participants