BRIEF
REPORTS

Are Self-study Procedural Teaching Methods Effective?

A Pilot Study of a Family Medicine Residency Program

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BACKGROUND AND OBJECTIVES: A family medicine residency is a unique training environment where residents are exposed to care in multiple settings, across all ages. Procedures are an integral part of family medicine practice. Family medicine residency (FMR) programs are tasked with the job of teaching these skills at a level of intensity and frequency that allows a resident to achieve competency of such skills. In an environment that is limited by work hour restrictions, self-study teaching methods are one way to ensure all residents receive the fundamental knowledge of how to perform procedures. We developed and evaluated the efficacy of a self-study procedure teaching method and procedure evaluation checklist.

METHODS: A self-study procedure teaching intervention was created, consisting of instructional articles and videos on three procedures. To assess the efficacy of the intervention, and the competency of the residents, pre- and postintervention procedure performance sessions were completed. These sessions were reviewed and scored using a standardized procedure performance checklist.

RESULTS: All 24 residents participated in the study. Overall, the resident procedure knowledge increased on two of the three procedures studied, and ability to perform procedure according to expert-validated checklist improved significantly on all procedures.

CONCLUSIONS: A self-study intervention is a simple but effective way to increase and improve procedure training in a way that fits the complex scheduling needs of a residency training program. In addition, this study demonstrates that the procedure performance checklists are a simple and reliable way to increase assessment of resident procedure performance skills in a residency setting.

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Graduates of family medicine residencies are expected to be competent in a variety of procedures. In 2008, the Society of Teachers of Family Medicine (STFM) Group on Hospital and Procedural Training developed a list of procedures within the scope of family medicine, and in 2009 created an advanced procedure list.[1, 2] The current Accreditation Council for Graduate Medical Education (ACGME) Family Medicine Requirements state that "residents must receive training in clinic procedures required for their future practices in ambulatory and hospital environments" and that each program is required to develop this list, as well as document objective procedure competence of each resident.[3] Procedural skills are not being adequately taught.[4-6] To learn a procedure, one must see a demonstration, practice, and have time to develop autonomy.[7,8] The busy resident schedule and current work hour restrictions create challenges in ensuring that all residents have the same opportunities to learn, observe, and perform procedures.[9]

While many methods are used to assess resident clinical skills, including procedural skills, few have been evaluated for validity.[10] Programs have relied on logbooks to track resident numbers, but these are not descriptive, nor do they track progress towards attaining competence.[8] Direct observation using a global and task-specific tool is a comprehensive approach that should be used when assessing competence in procedural skills,[11] however, few of these assessment methods and tools have been validated.[10, 12]

Given complex schedules, and the difficulty in providing procedure skills training to all residents, a self-study intervention was developed. This paper presents an educational intervention and the evaluation

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method used to assess resident performance.

Methods

This study used a pretest/posttest experimental research design on family medicine residents at the University of Colorado during the 2009-2010 academic year that was approved by the Colorado Multiple Institutional Review Board. Three procedures (intrauterine device [IUD] insertion, knee aspiration, and skin punch biopsy) were selected based on the frequency with which they were performed, faculty comfort level in teaching them, and resident interest in performing these procedures after graduation (Figure 1).[13] A procedure kit was assembled for each procedure that included a model of the body area (task trainer), and an equipment tray that included the tools needed to perform the procedure. A quiz consisting of multiple choice and true/false questions was written to assess residents' knowledge of the procedures (Table 1). Procedure performance evaluation checklists were created that included all the steps to prepare the patient for the procedure, perform the procedure, and provide postprocedure counseling (Table 2). Previous procedural competency instruments were used as templates.[14] We used content validity for validating these instruments using a group of experts in our faculty team. The procedure kits were set up in a procedure room with a camera to record the session. A self-study intervention was developed that consisted of instructional articles[15-17] reviewing each procedure and a link to videos demonstrating how to perform each one.[16-18] Each resident signed up for recording sessions.

During the preintervention sessions, the resident was instructed to complete the knowledge quiz, and then perform each procedure as if they were performing it on an actual patient. After completing the presession, the residents were emailed the self-study education intervention.[18-20] Four weeks after the preintervention session, the residents completed the postintervention session, which was exactly the same as the preintervention session. Upon completion of the pre- and postintervention sessions, the knowledge quizzes were scored and the authors reviewed the videos separately and completed the procedure performance evaluation

Figure 1: Flow Chart Demonstrating the Multiple Steps and Interventions for This Study

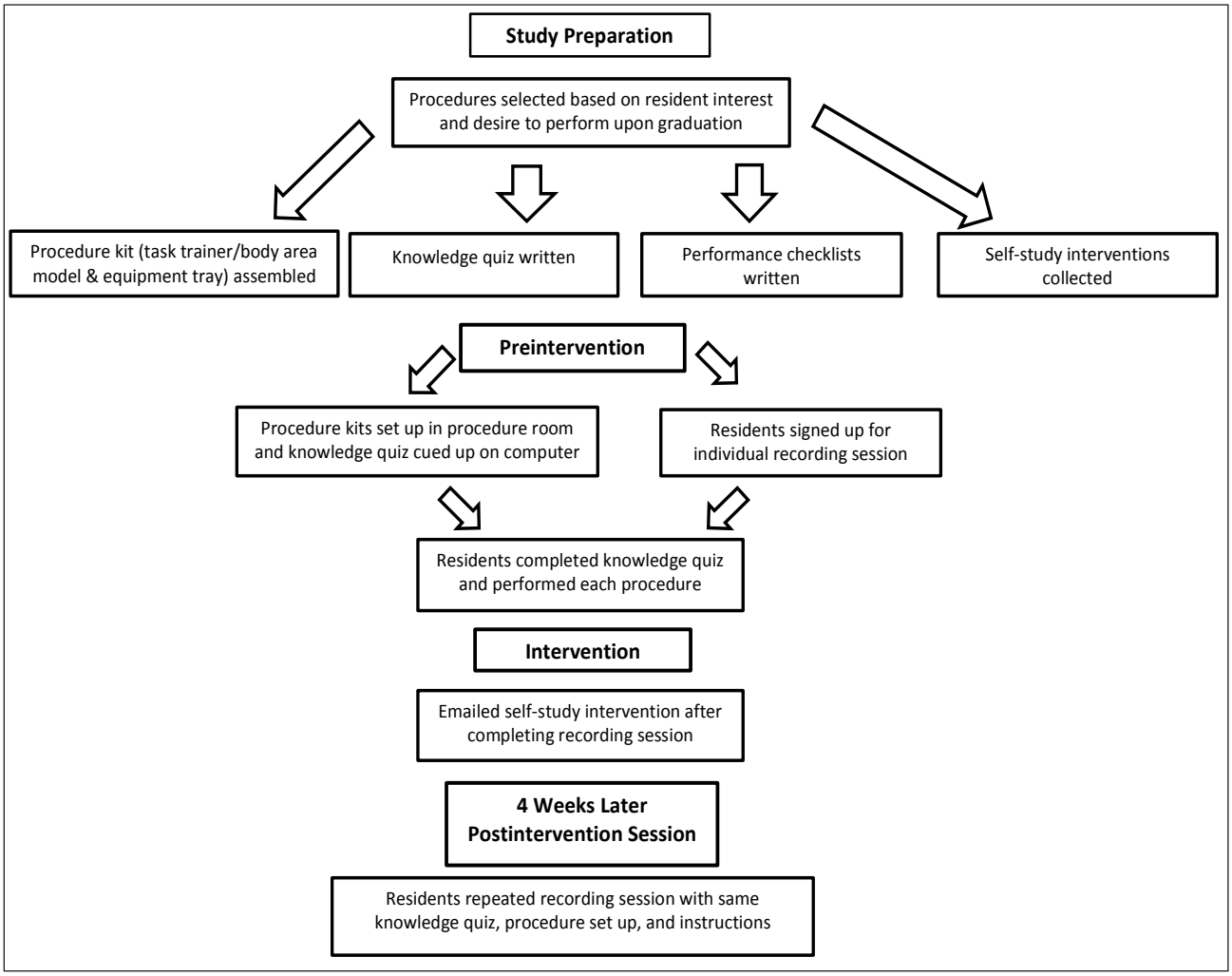


Table 1: Example of Knowledge-Based Quiz (IUD)

	True	False
1. Which of the following are not required steps in IUD insertion?		
Perform a bimanual exam to determine uterine size and position		
Use a uterine sound to measure the depth of the uterus		
Provide antibiotic prophylaxis		
Cleanse the cervix and vaginal walls with antiseptic solution		
Load the IUD into the applicator with sterile technique after sounding the uterus		
2. Contraindication for IUD use?		
Multiparous woman on her menstrual cycle		
Nulliparous woman in a monogamous relationship		
A woman who has had a prior miscarriage		
A woman with a history of PID and high risk sexual behavior		
A woman with unexplained vaginal bleeding who would like to stop her menses		
3. The copper IUD (Paragard)? (select all that are true):		
Releases levonorgestrel at 20 mcg/day		
Is ideal for women with heavy menses and dysmenorrhea		
Can be left in place for 10 years		
Can be left in place for 5 years		
Releases copper ions, which interfere with sperm motility and creates a spermicidal environment.		
4. The Mirena IUD? (select all that are true):		
Releases levonorgestrel at 20 mcg/day		
Is ideal for women with heavy menses and dysmenorrhea		
Can be left in place for 10 years		
Can be left in place for 5 years		
Releases copper ions, which interfere with sperm motility and creates a spermicidal environment		
5. An IUD must be removed before a patient has a colposcopy.		

checklists using a scale of 1: not competent, 2: partially competent, and 3: fully competent, as shown in Table 2.

We conducted statistical analyses with the IBM SPSS, version 23.0 (SPSS, Inc, Chicago, Illinois). We used descriptive statistics to examine the frequency, mean, median, and range for all variables. A Wilcoxon matched-pairs test for paired samples was used to assess the impact of the intervention on the data obtained in the two predetermined moments (pre- and postintervention).

Results

All 24 family medicine residents (eight PGY-1s, nine PGY-2s, and 7 PGY-3s) participated. Average procedure knowledge (Figure 2) on two of the three procedures (IUD insertion and punch biopsy) improved (Wilcoxon P=0.617, P=0.006, and P=0.016, respectively). After compiling all the procedure performance checklist scores, residents' procedure competency improved (Figure 3). The average competency score in knee arthrocentesis, IUD insertion, and punch biopsy significantly improved (Wilcoxon P=0.000, P=0.000, and P=0.000, respectively).

Discussion

There are many barriers that educators encounter when trying to teach procedures, including work hour restrictions, lack of a structured procedure curriculum, and absence of validated competency assessment tools. Workshops are a common teaching method, but are effective only when participants are able to practice those skills shortly after they are learned.[5] While workshops are still a valid teaching modality, self-study interventions are needed to accommodate work hour restrictions that can prevent residents from attending them.[9] A recent study compared the traditional in-person workshop to video module instruction for teaching IUD insertion, and it demonstrated that a video module was an effective and reliable method.[21] Our study demonstrates that a self-study intervention can improve resident knowledge and ability to perform a procedure.

Residents consistently express the desire for structured feedback. Programs struggle with providing this direct observation and formative feedback.[8] The competency checklists could help meet the needs of both residents and programs alike.

Table 2: Procedure Performance Evaluation Checklists: (A) Knee Arthrocentesis; (B) Punch Biopsy; and (C) Intrauterine Device Insertion

(A) Knee Arthrocentesis			
Resident _____	**Year: 1 2 3**		
Task	**Not Competent**	**Partially Competent**	**Fully Competent**
Informed Consent: Can state contraindications and describe risks, benefits, alternatives, and procedure			
Positions patient appropriately			
Identifies location for aspiration site			
Draws up appropriate dose of lidocaine			
Cleanses injection site with betadine/chloraseptic			
Chooses appropriate needle (gauge, length) for lidocaine injection			
Chooses appropriate needle (gauge, length, volume) for aspiration			
Passes needle through skin into joint			
Gently aspirates fluid			
Sends for testing as appropriate			
Sterile technique			
Gives patient appropriate post-aspiration instructions			
Evaluator _____			
Date Performed _____			
Comments:			

(B) Punch Biopsy			
Resident _____	**Year: 1 2 3**		
Task	**Not Competent**	**Partially Competent**	**Fully Competent**
Informed Consent: Can state contraindications and describe risks, benefits, alternatives, and procedure			
Adequately anesthetizes area to be biopsied			
Cleanses area with iodine/chloraseptic swabs			
Chooses appropriate size punch for lesion			
Creates small plug of tissue with punch			
Uses curved hemostat to lift tissue sample without crushing			
Uses scissors to cut sample at base			
Closes wound with suture as necessary			
Gives appropriate postop instructions			
Evaluator _____			
Date Performed _____			
Comments:			

(continued on next page)

Table 2, continued

(C) Intrauterine Device Insertion			
Resident _____		**Year: 1 2 3**	
Task	**Not Competent**	**Partially Competent**	**Fully Competent**
Informed Consent: Can state contraindications and describe risks, benefits, alternatives, and procedure			
Performs bimanual exam to determine uterine position			
Inserts speculum and cleanse cervix and vaginal walls			
Applies tenaculum to anterior lip of cervix			
Sounds the uterus			
Opens IUD package and loads IUD inserter with uterine depth marked			
Inserts IUD into uterus			
Cuts strings to 3+ cm			
Evaluator_____			
Date Performed_____			
Comments:			

Figure 2: Resident Performance Scores on Knowledge Quiz Pre- and Postintervention

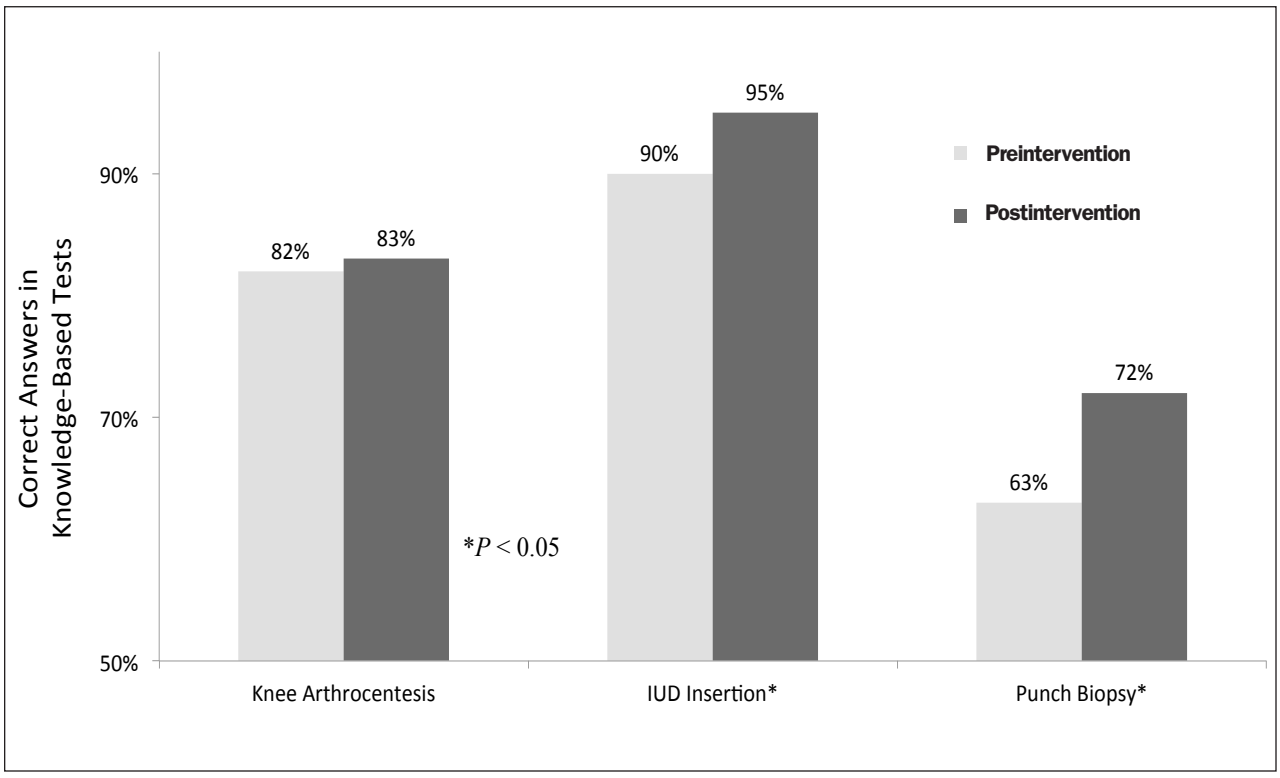
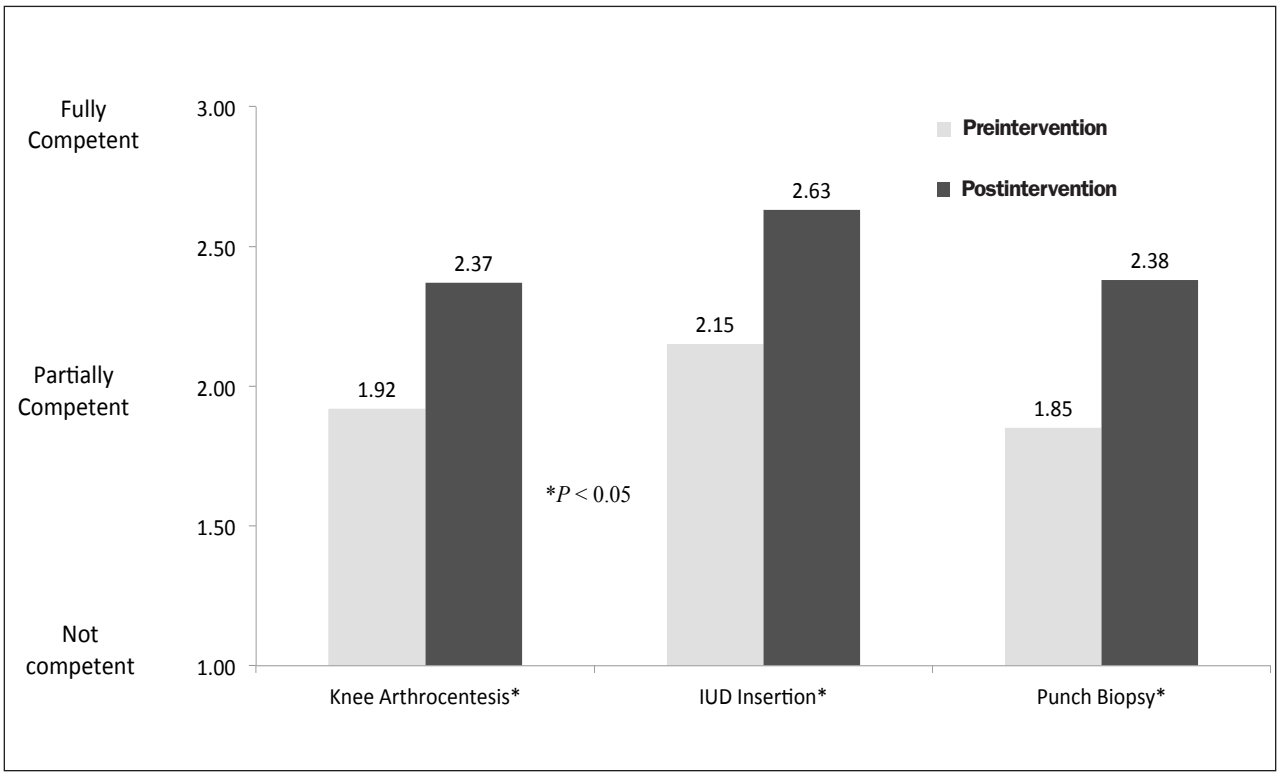


Figure 3: Resident Procedure Competency Ratings Pre- and Postintervention



These checklists allow the program to assess the skill level of each resident, provide a standardized procedure teaching method across the family medicine residency, and allow the resident to get structured feedback when used in a simulation or real patient encounter. As residency programs move from paper tracking systems to online programs and applications to track resident performance, validated procedure competency checklists should be included.

Despite all of the residents in the program participating in the study, one of the limitations of this study is its sample size. Our study serves as a proof-of-concept demonstrating that this modality of teaching and assessment is feasible. Additional studies would be required to look at knowledge retention and skill decay rates following educational interventions. Such studies would allow programs to look at frequency of educational interventions and deliberate practice sessions to attain and maintain competency. While this study demonstrates the effectiveness of the self-teaching intervention 1 month after completion of the preintervention session, it does not take into consideration when the resident completed the intervention, nor any exposure to, nor performance of, the procedures between the pre- and postintervention sessions. Recall bias is a limitation of the study design. It is possible that the improvement in the knowledge quiz scores has more to do with exposure to the previous quiz than the self-study intervention. Further large-scale studies with interrater reliability evaluation can help standardize these educational tools.

Our study demonstrates that a self-study intervention is an effective method for teaching procedures that can be used in combination with other teaching modalities. The performance checklists can help standardized procedure training, increase the amount of formative feedback residents receive, as well as track and document residents' procedure performance and eventual attainment of competence.

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