Perceptions on the impact of a Just-in-time (JIT) room on trainees and supervising physicians in a pediatric emergency department

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Abstract

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Background: In just-in-time (JIT) training, education occurs immediately prior to clinical encounters or procedures. An *in situ* JIT room in a Pediatric Emergency Department (ED) was created for procedural education and practice.

Objective: To examine trainee self-reported JIT room use, its impact on trainee self-perception of procedural competence/confidence, and the reported effect JIT

room usage has on need for intervention by supervising physicians during procedures.

Methods: A cross-sectional survey of residents rotating through the emergency department over one year. A separate survey was sent to supervising physicians. Outcomes included reported use of the JIT room, trainee procedural confidence, and frequency of supervisor intervention during procedures.

Results: Thirty-one out of 32 (97%) supervising physicians and 122/186 (66%) resident trainees completed the survey. 71% of responding trainees reported improved procedural confidence; 68% reported improved procedural skills after JIT room use. 29% of trainees state that supervisors intervene after JIT room use; while 38% state that supervising physicians intervene in procedures when they do not use the JIT room. 90% of supervisors reported having perceived improved trainee procedural confidence; 77% reported perceived improved trainee procedural skills after JIT room use. 58% of supervisors stated they intervene in procedures without trainee JIT room use, compared to 42% intervening when trainees use the JIT room.

Conclusions: Use of a dedicated just-in-time training space led to improved trainee confidence. In addition, supervisors reported they intervene less in procedures after JIT room use. A dedicated JIT room may be important in providing a medium for improving procedural competence, particularly in trainees who go on to practice pediatric medicine in low resource settings with minimal supervision.

Introduction

Increased supervision and work hour restrictions have led to fewer clinical opportunities for trainees, especially for those residents who are going on to practice in resource limited or rural settings. Simulation technology has been employed as a teaching modality for various clinical scenarios.[1] Simulation provides learning opportunities without exposing patients to potential harm that may occur while a trainee is learning a procedure.[2] Just-in-time (JIT) procedural training employs a simulated opportunity to practice a skill immediately prior to performing a procedure in an effort to maximize trainee learning, confidence, and patient safety.

Trainees value medical procedural simulation, and it has been promoted as an integral part of procedural education[3] as it can lead to increased procedural confidence[4,5,6] and improved procedural success.[7] Adult learning theory suggests that gaining a better understanding of learners' perspectives can assist educators in the implementation of a specific simulation curriculum.[3]

Seattle Children's Hospital (SCH) opened a new emergency department (ED) in April 2013 that included a JIT training room. It was designed to create a convenient space for procedural education prior to trainees performing procedures on actual patients. Stations for practicing splinting, suturing, and lumbar puncture skills are available 24 hours a day so that trainees may practice with minimal set-up time required. The JIT room is located near the ED clinical

space in order to maximize its accessibility to medical students and residents working clinical shifts and allow for deliberate practice. Deliberate practice (DP) refers to specific training as a structured activity designed to acquire or improve a critical aspect of performance and may be repeated as necessary with guidance and feedback in order to obtain a specific level of performance or mastery.[8,9] The JIT room was designed to allow for deliberate practice by providing a protected space that allows for complete concentration for skill development and improvement through error detection and correction, repetition, and access to feedback from a supervisor.[8]

While there have been numerous studies examining JIT training,[1,2,3,4,5,6,7,8,9] there have been no studies to date examining the use of dedicated JIT space as far as this researcher is aware. The purpose of this study was to examine the impact of this facility on medical trainee and supervisor experiences in the ED. This is especially relevant given that rotating in the pediatric emergency department may be the only pediatric procedural exposure that many of these residents receive prior to working in a resource limited or rural setting. Residents and supervisors were surveyed using Likert Scales and open-ended questions on:

1. The use of the JIT room,
2. The impact of perceived competences/confidence (reported self-perception of an ability to succeed) from having used the JIT room,
3. The effect the reported supervisor intervention during procedures from having used the JIT room.

The overall hypothesis was that using the JIT room for pre-procedural training improves trainee self-confidence, supervisor confidence in the trainee, and allows for less supervisor intervention during procedures.

Methods

Study Type and Setting: This was a cross-sectional survey study using a convenience sample of trainees and supervising physicians performed at a tertiary care pediatric hospital. The study was granted Institution Review Board exemption by the Seattle Children's Hospital Institutional Review Board.

Recruitment of Subjects: Residents (family medicine, emergency medicine, pediatrics) who had worked in the new ED and all PEM attendings and fellows were surveyed. Medical students and rotators from training programs that do not regularly train in the ED (e.g., visiting residents) were excluded.

Instruments: Two surveys were administered (Appendix 1 and 2): one to trainees (family medicine, emergency medicine, and pediatrics residents) and one to pediatric emergency medicine (PEM) supervising physicians (attending faculty / fellows). The surveys were validated by expert consultation with reviewers in the field of education and pediatric emergency medicine. It was pre-tested by various faculty members in the Division of Pediatric Emergency Medicine at the study institution for content and ease of use. The trainee survey had 14 items (see Appendix 1) and the supervising physician survey had 13 items (see Appendix

2). Of note, one item regarding specific procedural use of the JIT room (number of times it was used for suturing, splint, LP practice) was inadvertently left out of the trainee survey, so the total number of questions for trainees was 13. Survey data included demographic information from each respondent including years of training or years post training and specialty. Using 5 point Likert scales and numerical use of the JIT room, the surveys queried supervisors and trainees on their use of the JIT room, subsequent confidence in procedure performance, and need for supervisor intervention during procedures after use of the JIT room (Appendix 1 and 2). Open ended questions at the conclusion of the survey asked respondents about barriers to use of the JIT room, suggestions for improvements to the JIT room, and any procedures that participants would like to see added to the JIT room.

Data Collection: The anonymous surveys were developed using REDcap or Research Electronic Data Capture (Vanderbilt University; Nashville, TN), an online consortium platform to build and manage data collection forms, and a link to the survey was disseminated to eligible subjects via email. The survey was open from June 6 – July 11, 2014. Up to a maximum of 8 reminders were emailed to study subjects inviting them to complete the surveys. Thirty-one out of 32 (97%) of eligible supervising physicians and 122/186 (66%) of eligible residents completed the survey. The percent of residents who responded based on specialty are listed in Table 1.

Data Analysis: Descriptive analysis of survey responses was performed to characterize demographics of respondents and overall use of the JIT room. Paired t-tests were performed to assess use of the JIT room based on trainee self-reported competence, whether usage was associated with higher trainee perceived confidence or trainee procedural skills, and the need for supervisor intervention during procedures using Stata (Statacorp; College Station, Texas) and Microsoft Excel (Microsoft; Redmond, WA).

Results:

Resident responses

Surveyed trainees reported the JIT room is often used if the trainee felt insufficiently skilled in a procedure (Figure 1). Seventy one percent of trainees reported that their procedural confidence improved and 68% reported that their procedural skills improved after use of the JIT room. Twenty nine percent stated that supervisors intervened after use of the JIT room, while 37.7% state that supervising physicians intervened in procedures when they did not use the JIT room (p=0.3) (Table 2).

Supervisor Responses

With the presence of a dedicated JIT room, 93.5% of supervising physicians reported that they were more likely to use JIT training for procedural practice now that there is a dedicated room near the clinical space in the ED. No supervisors reported that they were less likely to do JIT training with the current set up. All

(100%) supervising physicians stated they use the JIT room if a trainee stated that she/he is not proficient in a procedure versus 19% if a trainee stated that she/he is proficient in a procedure. The JIT room is most frequently used to teach suture repair and LP skills, and less frequently used to teach splinting. 32.3% of supervising physicians used the JIT room >10 times to teach suturing, and 32.3% have used the JIT room >10 times to teach lumbar puncture. However, forty-eight percent of supervisors had never used the JIT for splinting (Figure 2). Ninety percent of supervising physicians reported their perception of trainee procedural confidence improved and 77.4% reported that trainee procedural skills improved after JIT room use. Fifty eight percent stated that they intervened in procedures when trainees do not use the JIT room while 41.9% stated that they intervened in procedures when trainees do use the JIT room (p= 0.005) (Table 2).

Discussion:

This is the first study examining the use of a dedicated JIT space in an academic ED as far as this researcher is aware. This study found high self-reported rates of use of JIT training by trainees and supervisors working in a pediatric ED with a dedicated JIT space. Both trainees and supervisors reported improved trainee skills and confidence with JIT room use. In addition, supervisors reported they intervened less in procedures after JIT room use; however, the difference in trainees' perception of supervisor intervention was not statistically significant.

The Accreditation Council for Graduate Medical Education (ACGME) has developed milestones for resident and fellow trainees which include procedural or technical skills under the core competency of patient care. With increasingly restricted duty hours, attending physician supervision, and focus on patient safety, it may be harder for trainees to attain core competence in procedural skills through patient care alone. Simulation based education, as in the JIT room, can provide a reproducible standard controlled environment for deliberate practice as well as both formative and summative assessment.[10] Procedural simulation may become a suitable replacement or training module for trainees, particularly those not used to working in pediatrics, or those planning to work in resource poor settings.

The JIT room's proximity to clinical space also created an optimally situated learning environment. The educational theory of situated learning proposes that effective learning occurs through workplace context and experiential participation.[11] In a situated learning model, learners and teachers are believed to offer unique perspectives on educational interventions. The results of this survey study therefore offer insight into the value and limitations on this model of JIT teaching.

While JIT learning is well grounded in educational theory, the results of studies on JIT teaching have been mixed. In a study of JIT training in infant lumbar puncture, frequency of procedural success was not affected by JIT training,[12]

Other markers of procedural proficiency, however, such as accurate initial placement of central lines, were improved after JIT practice.[7] This may point to a contextual issue with regards to situated cognition in that learning is inherent to the situation in which it occurs.[13] Perhaps a dedicated procedural training space such as a JIT training room that removes the learner from a distracting clinical environment while still physically being in the clinical space might improve trainee procedural success by providing a protected space for JIT deliberate practice.

Most residents and supervising physicians reported using the JIT room, particularly if a trainee felt insufficiently skilled to do a procedure. The majority of trainees and supervising physicians did not use the JIT room if a trainee stated that he or she was proficient in a procedure. This suggests that that the perceived value of the JIT room is in assessing the skill level of novice proceduralists and reinforcement of skills in a formative manner. More experienced trainee proceduralists were possibly presumed to be sufficiently skilled in procedures and did not require formative assessment or repeat skill training.

A majority of residents and supervising physicians felt that trainee procedural confidence and competence improved after use of the JIT room, However, there was a disconnect between trainees and supervisors in their perception of the effect of JIT training on supervising physician intervention during procedures. Trainees did not feel that use of the JIT room reduced supervising physician

intervention, while supervising physicians felt that use of the JIT room reduced their interventions in trainee-conducted procedures. This difference may suggest that supervising physicians perform an informal summative, or evaluative, assessment of trainees in the JIT room & therefore believe they intervene less in trainee procedures. Trainees may not perceive this change, and therefore perceived no difference in supervising physician intervention. Additionally, given their limited procedural opportunities, trainees may not have the perspective to sense a difference in physician supervisor intervention.

In the institution studied, the JIT room is primarily utilized for skill training and formative assessment. Trainees practice their procedural skills in the space, but are not explicitly required to demonstrate a certain level of competence before being allowed to perform a procedure. Future studies could be performed assess the effects of summative JIT assessment on procedural performance and outcome. Focus on summative assessment may be optimal for procedural success and perhaps ultimately, patient safety/outcome.

Survey results demonstrated that supervising physicians are primarily using the JIT room for suturing and LP practice, and not for splinting. Perhaps splinting may need a model to practice on as opposed to simply having splinting material available, or perhaps JIT splinting is too time-intensive, or that teaching for splinting may be easier facilitated at the bedside. It may be worthwhile to utilize space in the JIT room normally used for splinting for another procedure such as

gastric tube replacement or intubation. Adding multiple other task trainers to the room for procedures such as line placement, foreign body removal, and intubation, as suggested by trainees and supervisors, may encourage further use of the room. Adding these procedural simulations may translate to improved success or at least confidence in performing these procedures. In addition, these procedures can be pediatric specific but may not be as common, so providing mediums for allows for an alternate method of exposure as a trainee.

Both Trainee and supervising physicians reported that a lack of time was the major barrier to use of the JIT room. One trainee reported: *"[It is a barrier if it is] very busy in the ED. However, if we are about to do a procedure together, I think it is paramount to take time out for JIT in order to do procedures safely, and for learning, away from the patient care area."* Kamdar *et al* (2013) found this as a similar barrier for JIT infant LP trainer use as reported by pediatric interns.[1] This is perhaps a barrier that will exist with any JIT training in a busy clinical setting such as an ED. Standardizing the expectation that the room should be used for summative assessment prior to performing a procedure on a real patient may transform use of the room into a standard pre-procedure step. In that case, mandatory JIT training may be limited to novice trainees, who were perceived in this study to benefit most from JIT training. This has impact on the execution of safe procedures on pediatric patients as performed by trainees, particularly if those trainees go on to practice in resource poor settings. Pediatric procedural competency for these trainees can be limited to their experience in the pediatric

emergency department, and proficiency can impact patient care both at the time of that specific procedure, and also later on as independent practitioners. A follow-up study is currently underway assessing trainee laceration repair using a mastery competency checklist after use of the JIT training room.

Limitations

A limitation of the study is that it utilizes a convenience sample. Surveys were used in an attempt to get a census result of all participants in the program, with the assumption that all surveyed users of the JIT Room would be representative of a broader population of trainees and supervisors in similar hospitals, had they had access to a similar facility. Another limitation of this study is its reliance on self-report and perceptions, which reflect what a study subject thinks at a particular point in time. The study may therefore be affected by both recall and reporting bias. An attempt to diminish reporting bias was made by keeping surveys anonymous and to keep gathered results protected from program leaders. Additionally, survey methodology was chosen to gain the learners' perspective in order to gain insight to effectively shape teaching methodology.[11] However, this did not allow a measurement of definitive endpoints such as patient satisfaction or procedure outcome.

Future Directions

Simulation-based education has been associated with some patient benefits when compared to no intervention and non-simulation instruction.[14] This study

highlights the need to quantify the impact of practice in the JIT room on patient outcomes. Potential outcomes to be studied include patient procedural satisfaction, procedural success, or direct observation of procedural proficiency.

Conclusions:

A majority of residents report receiving JIT training in a pediatric ED with a dedicated JIT training space. In addition, supervisors and trainees agree that trainee skills and confidence improve with JIT room use, and both report utilizing the JIT room when trainees do not feel proficient in a procedure. Supervisors report that they intervene less in procedures after JIT room use. However, trainees sense no difference in supervisor intervention behavior regardless of JIT room use.

A dedicated JIT room may be important in improving trainee skills and confidence and in decreasing supervisor intervention in procedures. These results may be applicable to other emergency departments working to improve procedural training and competence, particularly those that have non-pediatric trainee rotations (family medicine and emergency medicine)—as a JIT Room training may be the only procedural pediatric training they receive prior to practicing on their own.

Table 1: Specialty and post-graduate training year for Trainee Respondents

Specialty and Post-Graduate Training Year for Trainee Respondents % (N)				
	Year 1	**Year 2**	**Year 3**	**Total**
Pediatrics	21.3% (26)	22.1% (27)	21.3% (26)	64.8% (79)
Emergency Medicine	4.1% (5)	4.1% (5)	7.4% (9)	15.6% (19)
Family Medicine	3.3% (4)	12.3% (15)	4.1% (5)	19.7% (24)
Total	28.7% (35)	38.5% (47)	32.8% (40)	122

Figure 1: Trainee Use of JIT Room

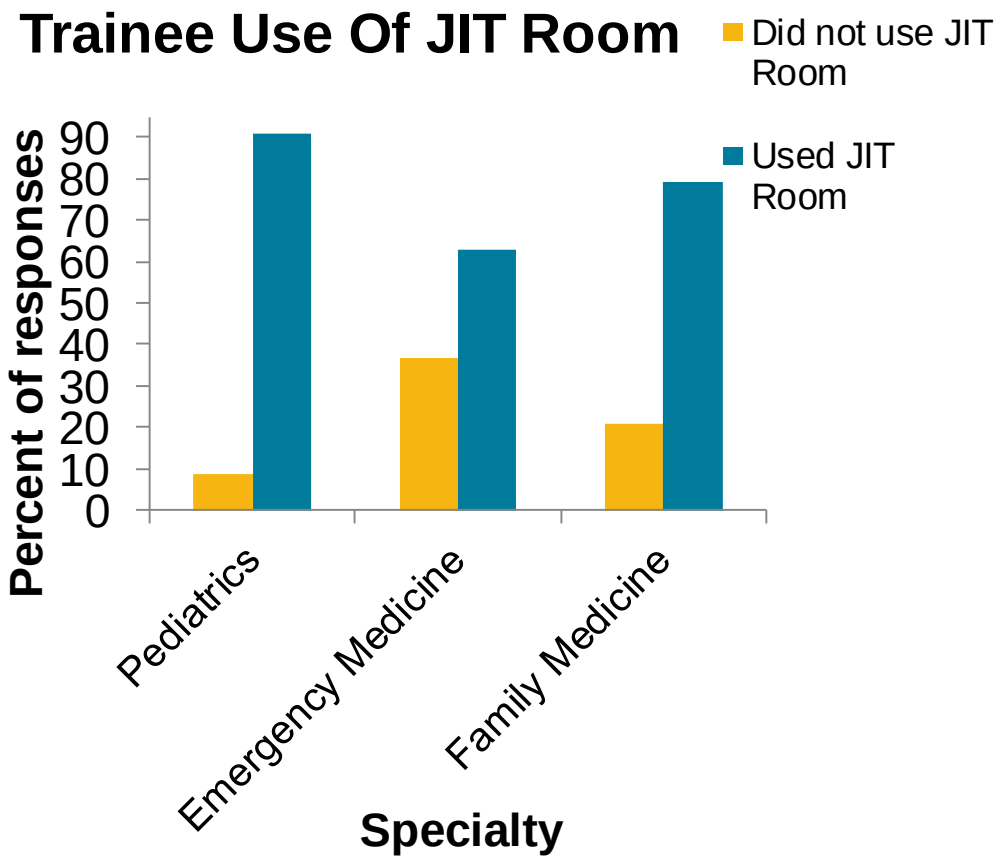

Figure 2: Supervisor Use Of The JIT Room

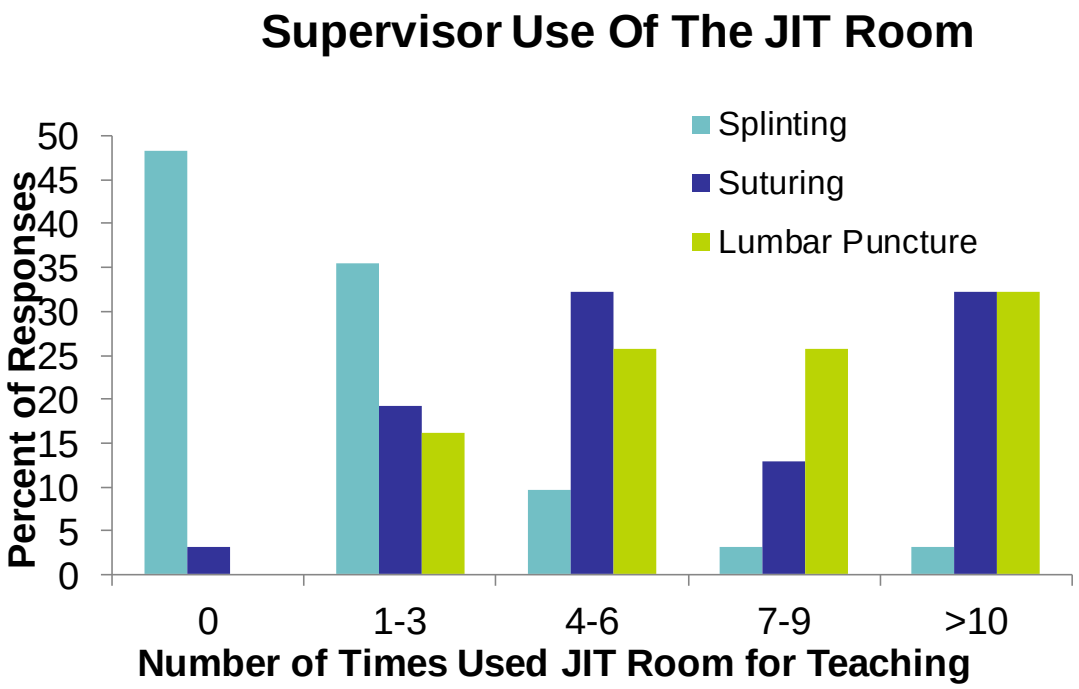

Table 2: Trainee Impression of Proficiency

Question	If JIT Room Used	If JIT Room NOT used	Paired Difference	95% CI	P value
Trainee feels proficient in a procedure	4.0	2.6	+1.4	(1.1, 1.6)	<0.001
Trainee Reported Supervisor Intervention	2.7	2.7	-0.04	(-0.1,0.04)	0.3

Mean Likert scale scores of use of the JIT room on a scale of 1-5. 1=strongly disagree, 2=disagree, 3=undecided, 4=agree, 5=strongly agree. Trainees felt that they used the JIT room if not proficient in a procedure. Trainees did not sense a difference in supervising physician intervention in a procedure after use of the JIT room.

Table 3: Supervisor Impression of Proficiency

Question	If JIT Room Used	If JIT Room NOT used	Paired Difference	95% CI	P value
(supervisor view that) Trainee feels proficient in a procedure	4.7	2.8	+1.8	(1.5, 2.2)	<0.001
Supervisor intervenes	3.2	3.6	-0.4	(-0.7,-0.1)	0.005

Mean Likert scale scores of use of the JIT room on a scale of 1-5. 1=strongly disagree, 2=disagree, 3=undecided, 4=agree, 5=strongly agree. Supervising physicians felt that they use the JIT room with a trainee if they feel a trainee is not proficient in a procedure. Supervising physicians sensed that they intervened less after use of the JIT room.

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Acknowledgements:

Study data were collected and managed using REDCap electronic data capture tools hosted at The University of Washington.[*] REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources.

[*]Paul A. Harris, Robert Taylor, Robert Thielke, Jonathon Payne, Nathaniel Gonzalez, Jose G. Conde, Research electronic data capture (REDCap) - A metadata-driven methodology and workflow process for providing translational research informatics support, J Biomed Inform. 2009 Apr;42(2):377-81.

Appendix 1: Trainee Survey

1. Select your training program:

☐ Pediatrics
☐ Emergency Medicine
☐ Family Medicine
☐ Other (specify)_____

2. Select your current level of training:

☐ PGY1
☐ PGY2
☐ PGY3
☐ PGY4

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3. How likely are you to engage in just-in-time procedural practice now that there is a dedicated space for JIT training?

☐Less likely ☐Just as likely ☐More likely

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
4. JIT training is an effective tool for improving procedural skills	☐	☐	☐	☐	☐
5. My procedural confidence has improved after using the JIT room	☐	☐	☐	☐	☐
6. My procedural skills have improved after using the JIT room	☐	☐	☐	☐	☐

	Never	Rarely	Occasionally	Frequently	Always
7. I use the JIT room if I feel proficient in a procedure	☐	☐	☐	☐	☐
8. I use the JIT room if I feel inadequate in a procedure	☐	☐	☐	☐	☐
9. Supervising physicians intervene in procedures when I do not use the JIT room	☐	☐	☐	☐	☐
10. Supervising physicians intervene in procedures after I use the JIT room	☐	☐	☐	☐	☐

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11. What are barriers to the use of the JIT room?

12. What can be done to improve the JIT room?

13. What procedures, if any, you would like to see added to the JIT room?

Appendix 2: Supervisor Survey

1. Select your level of training? (select all that apply):

☐ Fellow
☐ Attending

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2. How likely are you to use the JIT room for trainee procedural practice now that there is a dedicated space for JIT training?

☐ **Less likely** ☐ **Just as likely** ☐ **More likely**

3. For each of the following procedures, indicate how often you have used the JIT room for trainee teaching:

Splinting	☐ 0	☐ 1-3	☐ 4-6	☐ 7-9	☐ >10
Suturing	☐ 0	☐ 1-3	☐ 4-6	☐ 7-9	☐ >10
Lumbar puncture	☐ 0	☐ 1-3	☐ 4-6	☐ 7-9	☐ >10

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
4. JIT training is an effective tool for improving procedural skills	☐	☐	☐	☐	☐
5. Trainee procedural confidence improves after use of the JIT room	☐	☐	☐	☐	☐
6. Trainee procedural skills improve after use of the JIT room	☐	☐	☐	☐	☐

	Never	Rarely	Occasionally	Frequently	Always
7. I use the JIT room if a trainee states he/she is proficient in a procedure	☐	☐	☐	☐	☐
8. I use the JIT room if a trainee states he/she is not proficient In a procedure	☐	☐	☐	☐	☐
9. I intervene in procedures when trainees do not use the JIT room	☐	☐	☐	☐	☐
10. I intervene in procedures after trainees use the JIT room	☐	☐	☐	☐	☐

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11. What are barriers to the use of the JIT room?

12. What can be done to improve the JIT room?

13. What procedures, if any, you would like to see added to the JIT room?