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Implementation of an Intraosseous Device Task Trainer to Improve Confidence and Skill Performance

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Copyright Acknowledgment Statement

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Disclaimer

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Abstract

Lack of training, inexperience, and equipment failure can lead to delays in establishing vascular access in adult patients in an emergency (Witting, 2012). This can cause untimely interruptions to the delivery of emergent interventions. Studies comparing Intraosseous (IO) and central venous access show that IO access is more likely to be successful on the first attempt and takes less time (Leidel, et al. 2009; Fuchs & Lacovey, 1991). IO access has been shown to be easier to perform than peripheral venous access during medical emergencies. However, many providers lack confidence and training placing IOs (Leidel, et al. 2009). The purpose of the project was to improve efficiency in emergency vascular access scenarios utilizing an EBP training program for IO placement designed to improve SRNA (Student Registered Nurse Anesthetist) success and self-confidence.

The study utilized a pre/post education intervention. 1. SRNAs filled out a pre-intervention confidence survey and performed a simulated, graded IO placement. 2. The SRNAs were given hands-on training and shown educational videos. 3. Students performed a simulated IO placement. 4. They were graded on performance a second time and filled out a post-intervention confidence survey.

The results of the project support the best practice literature, which indicates that simulation-based training is effective in improving performance (Cartier et al., 2016) and confidence (Sergeev et al., 2012). The evidence-based simulation training increased comfort and performance among the SRNA cohort. The use of the video instruction also corroborated the literature (Saun et al., 2017). Though the number of participants is small, they showed consistent improvement after the training in all areas measured.

The authors recommend that the Uniformed Services University (USUHS) Graduate School of Nursing (GSN) implement an IO device task trainer as part of the Phase I SRNA curriculum. This would give the SRNAs some familiarity with the devices before they disperse to their Phase II clinical sites. By utilizing a standardized, evidence-based training future CRNAs (Certified Registered Nurse Anesthetist) will have the confidence to utilize IOs in the hospital and the forward setting.

Introduction

Intraosseous (IO) vascular access is a critical skill recommended by the Tactical Combat Casualty Care committee (TCCC-MP Guidelines and Curriculum, 2019). The IO route can support rapid fluid administration with rates up to 200ml/min, which is ideal in trauma or emergency resuscitation (Ngo, Oh, Chen, Yong, & Ong, 2009). All fluids and medications that can be given through a peripheral intravenous catheter (IV) are considered safe for delivery through an IO line. Obtaining venous access in patients experiencing shock, trauma, burns, sepsis, dehydration, or severe edema may be difficult or impossible due to loss of vasomotor tone and vascular collapse. Intraosseous space is not susceptible to loss of vascular tone and is easier to identify. The IO route is recommended for use in these situations due to their high placement success rate (90%). This compares favorably to the first-time failure rate of peripheral IVs, which is between 10%-40% (Pepitas et al., 2016). Although obtaining IO access is a rudimentary procedure, most providers rarely utilize this option due to limited training and exposure (Pepitas et al., 2016). Currently, USUHS does not provide routine IO training for SRNAs. The authors implemented an evidence-based IO training program to improve provider confidence and skill proficiency.

Significance of the Problem

Lack of training, inexperience, equipment failure and inability to correctly place intravenous catheters can lead to delays establishing vascular access in adult patients in an emergency. Delays in vascular access prevent the administration of essential intravenous medications and fluids. Failure to obtain vascular access can result in serious and potentially irreversible consequences for patients experiencing life threatening situations that require immediate treatment (Witting, 2012).

The central venous catheter (CVC) is an alternative, but time consuming and invasive method of obtaining vascular access in an emergency situation. The CVC is effective for the administration of fluids, blood products, and medications; however, insertion of a CVC requires time and competency beyond the scope of many providers and carries the risk of inadvertent pleural or arterial puncture. (Belkouch et al. 2015). IO access is more readily placed on the first attempt compared to CVC (90% vs 60%, respectively) and takes less time (Leidel, et al. 2009; Fuchs & Lacovey, 1991). In fact, IO access has been shown to be easier to perform than traditional peripheral venous catheters (PVC) in emergent situations (Leidel et al., 2009). IO is a simpler and faster procedure than both PVC and CVC placement. Compared to CVCs, IO insertion has relatively few associated risks, a high operator satisfaction, and a high rate of success for inexperienced clinicians (Leidel et al., 2009).

A lack of provider skill and confidence in IO insertion is significant because it is a life-saving alternative method to obtaining vascular access (Ngo, Oh, Chen, Yong, & Ong, 2009). A lack of training means that providers may not even consider using an IO device when faced with a difficult access situation. It is important that providers be familiar with IO access so that it can be an option in situations where time is critical (Ngo, Oh, Chen, Yong, & Ong, 2009). Improving training for intraosseous access will reduce the time to delivery of life-saving interventions while increasing provider confidence with the procedure (Sergeev et al., 2012).

Relevance to Military Nursing

Competency and familiarity with IO access is not only critical in the hospital setting; it can also provide significant benefits in the military trauma setting. From 2006 to 2013, over 1000 IOs were inserted during combat operations in Afghanistan (Lewis & Wright, 2014). The latest Tactical Combat Casualty Care guidelines recommended that, "if vascular access is needed but not quickly obtainable via the IV route, use the IO route" (TCCC-MP Guidelines and Curriculum, 2019). In order to ensure successful IO placement, providers need practice. Nurse anesthetists may find themselves in situations where vascular access cannot be obtained in the austere environment and fluid resuscitation is critical to patient survival (Rush, D'Amore, & Boccio, 2014).

The types of injuries sustained in the operational environment can make peripheral access difficult to obtain. Tactical and environmental circumstances including mass casualties, logistical conditions, and transportation limitations are also major barriers to peripheral access. IOs can be used at point of injury to initiate emergency resuscitation. The simplicity, speed and minimal complication rate of IO needles are highly desirable in an operational setting (Rush, D'Amore, & Boccio, 2014).

Clinical Question

In SRNAs USUHS, does the implementation of an intraosseous access (IO) device task trainer and video demonstration improve the comfort level and success rate of the placement of an IO device?

Literature Review of Solution

A literature review was completed using the databases Pubmed and CINAHL. All database searches included the same search terms. The literature review was limited to peer-reviewed journals in English published from January 2007-2020. Terms were separated into subject categories based on presence in the existing literature. The following MESH terms were derived: Infusions, Intraosseous, IO access, training, education, workshop, learning, Emergency Medical Services, Emergency Treatment, OR, Hospitals, prehospital, emergency. Exclusion criteria were Non-adult, Non-Nurse, Non-physician. The articles were isolated and individually reviewed by each member of the team. Themes were identified and annotated using an evidence table (Appendix E).

The Johns Hopkins Nursing Evidence-based Practice Rating Scale was used to evaluate the literature. (Newhouse, Dearholt, Poe, Pugh, & White, 2005). When appraising the literature, the authors adhered to Level 1A and Level 1B strength evidence. Initially, 172 articles were identified. After the removal of duplicates, 135 articles were left. Furthermore, 126 articles were excluded because they were part of a pre-hospital study, not an RCT, not directly related to IO access, part of a pediatric study, animal study or an instructional study. Nine articles were included after the evidence review. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart is included as graphical representation of the literature review (Appendix F).

Focus Areas

1. Identify: The authors conducted a literature review to determine the best evidence-based solution regarding IO training.
2. Conduct: A training program was implemented; SRNAs were evaluated on confidence and skill proficiency before and after the program.

3. Disseminate: The findings of the project were presented to USUHS during Research Week of May 2021. (Appendix G).

Organizational Framework

The Iowa Model provides a step-by-step framework to guide evidence-based change (Brown, 2014). This model involves a multi-step approach to help translate evidence into practice. The first step is to identify either a "problem-focused trigger or a knowledge-focused trigger" that warrants the change (Brown, 2014). The second step is to determine the effectiveness of the current process. The final step of the Iowa Model is to pilot change into practice.

The authors utilized the Iowa Model of Evidence-Based Practice as a framework to guide this evidence-based project (Appendix H). The problem identified was the lack of exposure to IO training and access. There is currently no simulation training for IOs in place at USUHS, so the project was started to address this deficiency. After a review of the literature to determine the most effective teaching methods, a simulation training program was developed and implemented at USUHS.

Project Design

General Approach

In this process improvement project, SRNAs were assessed for skill and confidence at IO placement before and after hands on training. The training consisted of a simulated portion and an educational video.

Setting and Population

The setting for the project was USUHS, in Bethesda, MD. The population of interest was GSN students in the Class of 2022 SRNA program. This cohort was comprised of 16 active duty

Navy, Air Force, and Army students. They had varied nursing backgrounds, but all had critical care experience and the majority were certified critical care nurses.

Procedural Steps

Pre-Implementation Step

SRNA faculty at the GSN was consulted to determine an appropriate time to conduct training based on the current curriculum schedule and current CDC (Center for Disease Control) Covid-19 guidelines. Next, internal review board (IRB) exemption at USUHS was obtained. Before beginning the hands-on portion of the project, baseline data was collected (to include demographics, previous IO experience and confidence levels) from the SRNAs. The confidence measures were derived from a validated tool and included include three questions based on 5-point Likert scale (Appendix I) (Nemoto & Beglar, 2014).

Implementation Step

Each SRNA performed a simulated IO placement on an EZ-IO trainer without practice. They drilled IOs into a manufactured humerus bone covered with skin-like silicone. Facilitators graded the baseline skill of each SRNA using a checklist comprised of eight essential steps obtained from the literature (Afzalil, M., Lyngeraa, T., Viggers, S., 2017) (Appendix J). The facilitators also provided the training for the hands-on portion of the project. Following this assessment, the SRNAs received video and hands-on training. The EZ-IO video was four minutes long and produced by Teleflex.

The workshop was carried out using a modified version of Walker and Peyton's four-step approach as the teaching method (Nikendei, et al., 2014).

1. The facilitators demonstrated an IO insertion, in real time. This step took five minutes.

2. The facilitators went through the tasks verbally breaking them down into small, simple steps. This took another five minutes.
3. The instructor performed the task while the students instructed in a step-by-step fashion over five minutes.
4. Students performed the task with immediate instructor feedback. Twenty minutes was allotted for this portion so that each student could receive feedback individually.

The students were allowed to practice with the task trainer and asked questions for the remainder of the one-hour session, until they felt comfortable. Following a 15-minute break, SRNAs performed the simulated IO placement for a second time and facilitators again graded the students using the skills checklist (Afzalil, M., Lyngeraa, T., Viggers, S., 2017) (Appendix J). The final portion of the assessment took twenty minutes. The total time commitment for each student was approximately two hours.

Post-implementation Step

The confidence survey (Appendix I) was conducted after the simulation. SRNAs rated their likelihood of using an IO in an emergency in the future. The pre and post training skills checklists were compared. Following data analysis, the authors presented the results to the SRNA faculty with a recommendation for IO training and a sustainability plan moving forward. The authors were unable to assess knowledge retention in this cohort due to time constraints.

Data analysis

The data obtained includes branch of service, any previous intraosseous access training or experience using the device, number of years as a critical care nurse, previous experience placing an IO device and pre and post implementation data (provider confidence on a Likert scale and data from a skills checklist). Descriptive statistics were used for demographic data and non-parametric tests were used to compare nominal and ordinal pre and post implementation data. A statistician was consulted to analyze the data.

Potential Barriers

Potential barriers to the success of the project fell under four categories: Behavior beliefs, subjective norms, control beliefs and curricula scheduling conflicts.

1. Behavior beliefs: A preconceived negative personal attitude towards using an IO because of inexperience posed a potential issue.
2. Subjective norms: Peer pressure not to use an IO because of staff unfamiliarity or infrequent use was a barrier to convincing providers to consider the IO.
3. Control beliefs: Provider confidence that he or she will always be able to place an IV or CVC and therefore does not need to learn to use the IO was a potential problem.
4. Scheduling conflicts: Scheduling conflicts with the SRNA curricula at USUHS was the biggest barrier to the project, which was conducted during the coronavirus pandemic.

To mitigate these barriers, the authors performed a literature review to provide evidence that the IO simulation training would improve confidence and competence. The training day was scheduled to allow for maximum participation. The SRNAs were broken up into groups to meet social distancing guidelines in effect at the time.

Sustainment and Dissemination Plan

The authors recommend that USUHS faculty implement the IO simulation-based task trainer within the Registered Nurse Anesthetist Doctoral curriculum. The cost of obtaining a task trainer can be initially mitigated using the devices used by other training courses required in the GSN. Further inquiry into purchasing simulators specifically for this task-trainer can be addressed once sustainment is established. The project findings were disseminated at USU Research Week in May of 2021.

HIPPA Concerns

This project involved the collection of skills evaluation data from students at the Uniformed Services University of the Health Sciences. Personally identifiable information (PII) or protected health information (PHI) was not collected during the course of this project. The project was submitted for review by the USUHS IRB to verify compliance with the DoD privacy program (DoD Directive 5400.11) and the Health Insurance Portability and Accountability Act (HIPAA). This project was submitted as an evidence-based process improvement project; an IRB research exemption was obtained. All anonymous data (de-identified) was stored on a CAC enabled computer.

Project Results

The collected data was analyzed for normality using the Kolmogorov-Smirnov test and pre and post training program data did not pass normality testing, therefore, non-parametric data analysis was used. A Wilcoxon matched-pairs signed rank test revealed a statistically significant increase in comfort placing an IO needle following participation in the training program, $p < 0.001$. The median Likert scale score (0 to 4) related to comfort with placement increased from pre-training ($Md = 1.5$) to post-training ($Md = 3.5$).

A Wilcoxon matched-pairs signed rank test revealed a statistically significant increase in comfort with locating the placement of an IO needle insertion site following participation in the training program, $p < 0.001$. The median Likert scale score (0 to 4) related to comfort with locating the placement of an IO needle insertion site increased from pre-training (Md = 2) to post-training (Md = 3.5).

A Wilcoxon matched-pairs signed rank test revealed a statistically significant increase in willingness to place an IO needle in an emergency following participation in the training program, $p < 0.001$. The median Likert scale score (0 to 4) related to comfort with placement increased from pre-training (Md = 2) to post-training (Md = 4).

A Wilcoxon matched-pairs signed rank test revealed a statistically significant increase in the IO skills checklist score following participation in the training program, $p < 0.001$. The median skills checklist score (max score 15) related to comfort with placement increased from pre-training (Md = 12) to post-training (Md = 15). Following the training program, participants stated they were either extremely (n = 10) or very likely (n=6) to place an IO in an emergency setting. The results of the project are graphed in Appendix L.

Analysis of the Results

The results of the project support the best practice literature, which indicates that simulation-based training is effective in improving performance (Cartier et al., 2016) and confidence (Sergeev et al., 2012). The evidence-based simulation training increased comfort and performance among the SRNA cohort. The use of the video instruction also corroborated the literature (Saun et al., 2017). Although the number of participants is small, they showed consistent improvement after the training in all areas measured. Repeating the project with a greater number of participants may be an endeavor worth taking in the future.

Organizational Impact

The authors recommend that USUHS implement an IO device task trainer as part of the Phase I SRNA curriculum. The training for 16 SRNAs took approximately two hours and required minimal equipment and set up. It could also be expanded to the Family Nurse Practitioner program if scheduling allows. This would give the SRNAs some familiarity with the devices before they disperse to their Phase II clinical sites. A standardized, evidence-based training program could help future CRNAs utilize IOs in the hospital and the forward setting.

Future Directions for Research and Practice

More research could be done in regard to IO training specifically and increased implementation of recurrent training to increase skill sustainment. While there are many studies examining the best way to train students in the placement of central lines and chest tubes, very few studies that focused on IOs exist. IO placement is a crucial skill that not many medical staff have the opportunity to practice until an emergency occurs. It would benefit the medical community to have more rigorous studies with better recommendations for training people to use the IO devices.

As previously mentioned, the project had a small number of participants. If the project were to be repeated in the future, it would be preferable to have more participants. This would give more credibility to the results of this project. It is difficult to ascertain definitive conclusions without statistical significance. If the project had taken place at a larger facility over a longer period of time, the number of participants may have been greater. Multiple training points could have been implemented to determine skill sustainment at scheduled time frames.

Due to time constrains, the SRNAs were not retested for their retention of the training. This would have provided a better picture of the long term benefits of simulation training. This is a valuable piece of information, as the SRNAs may not use an IO again until they graduate and or deploy. The true long term benefit of this project remains unclear.

Conclusion

The project successfully improved the confidence and performance of SRNAs placing IOs through simulation and video training. It was supported by the literature and was relatively quick and easy to execute. The authors recommend that an IO training program be implemented at USUHS. If the project were to be repeated in the future, a greater number of participants should be used. It would also be beneficial to repeat the project to assess for retention of skills.

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Appendices

Appendix A: Citi Certificates


CITI PROGRAM

Completion Date 22-Aug-2018
Expirat on Date 21-Aug-2021
Record ID 28264468

This is to certify that

Taylor Brocuglio

Has completed the following CITI Program course

OUSD P&R Human Research (Curr culum Group)
Biomedical Investigators and Research Study Team (Course Learner Group)
1 - Biomedical Investigators (Stage)

Under requirements set by

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wd6cd3d6f-a0b9-4048-94fa-fc185bf79a38-28264468


CITI PROGRAM

Completion Date 26-Aug-2018
Expirat on Date 25-Aug-2021
Record ID 28309913

This is to certify that

Petersen Neal

Has completed the following CITI Program course

OUSD P&R Human Research (Curr culum Group)
Biomedical Investigators and Research Study Team (Course Learner Group)
1 - Biomedical Investigators (Stage)

Under requirements set by

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wb6a805a6-a792-40d3-a716-edbfdfceebcb-28309913


CITI PROGRAM

Completion Date 22-Aug-2018
Expiration Date 21-Aug-2021
Record ID 28270987

This is to certify that

Caroline Mosher

Has completed the following CITI Program course

Not val d for renewal of certification through CME.

OUSD P&R Human Research
(Curriculum Group)
Biomedical Investigators and Research Study Team
Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI

Verify at www.citiprogram.org/verify/?we6311619-e54b-4fe5-a70d-a0ad401b5a0a-28270987

Appendix B: USU (VPR) Form 3202N (final copy from Office of VPR)

Uniformed Services University

OFFICE OF RESEARCH
4301 JONES BRIDGE ROAD
BETHESDA, MAYLAND 20814
PHONE: (301) 295-3303; FAX: (301) 295-6771

NOTICE OF PROJECT APPROVAL

Change Number: Original

VPR Site Number: GSN-61-11175

Principal Investigator: Petersen, Neal

Department: Graduate School of Nursing

Project Type: Student

Project Title: Implementation of an Intraosseous Device Task Trainer to Improve Confidence and skill Performance

Project Period: 3/23/2020 to 3/30/2021

Assurance and Progress Report Information:

Name	Sup	Approval Type	Status	Approved On	Forms Received
Progress Report	0			To be Submitted	N/A

Remarks:
This Notice Of Project Approval has been reviewed and approved. Please remember that you must submit a final Progress Report (Form 3210) upon completion of this project.

Questions regarding this approval should be directed to the following person in the Office of Research:
Sharon McIver, (301) 295-9814.

Toya V. Randolph, Ph.D., MSPH Date
Acting Vice President for Research
Uniformed Services University of the Health Sciences

cc: File
Radford, Kennett
Taylor, Laura

Appendix C: MTF IRB/PI Letter of Determination

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIE

4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND
20814-4799
www.usuhs.edu

June 16, 2020

MEMORANDUM FOR DR DOUGLAS TIMOTHY JOHNSON, UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES, DEPARTMENT OF GRADUATE SCHOOL OF NURSING

SUBJECT: Uniformed Services University (USU) Human Research Protections Program (HRPP) Determination of Not Research for Protocol DBS.2020.127

Protocol DBS.2020.127 entitled ***"Implementation of an Intraosseous Device Task Trainer to Improve Confidence and Skill : A Quality Improvement Project-Challenges and Best Practices"*** was reviewed on June 9, 2020, by the Uniformed Services University's Human Research Protections Program Office and determined not to meet the criteria defining research at 32 CFR 219.102, and applicable DoD policy guidance. As such, this protocol does not require Institutional Review Board (IRB) review.

This is a quality improvement project where a pre/post education intervention will Be utilized. SRNAs will fill out a pre-intervention confidence survey and perform a simulated IO placement. They will be graded on performance. Hands-on training will then be conducted, including an educational video. Students will again perform a simulated IO placement. They will be graded on performance a second time and fill out a post-intervention confidence survey.

Should your project data sources, personnel, or methodology change, please contact this office before you begin any new phase of your work so that we may review it with you. Otherwise, we cannot ensure you will be incompliance with all applicable human subject research regulations. The IRB/HRPPO staff is a key resource that is available to assist you to ensure you are in compliance with applicable human research regulations.

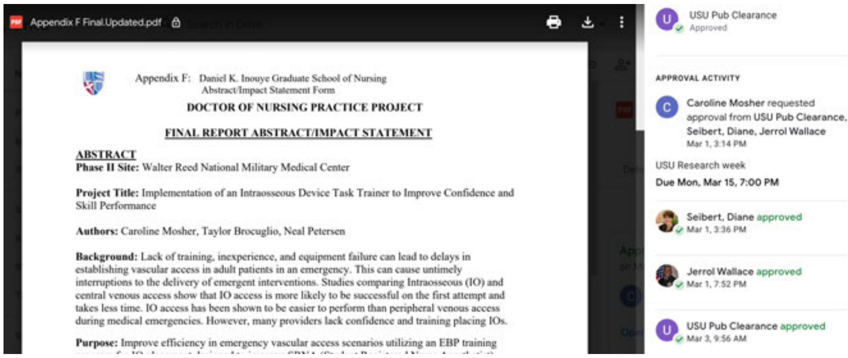
If you have questions regarding this action, or questions of a more general nature concerning human participation in research, please contact Chris Murphy at [redacted]

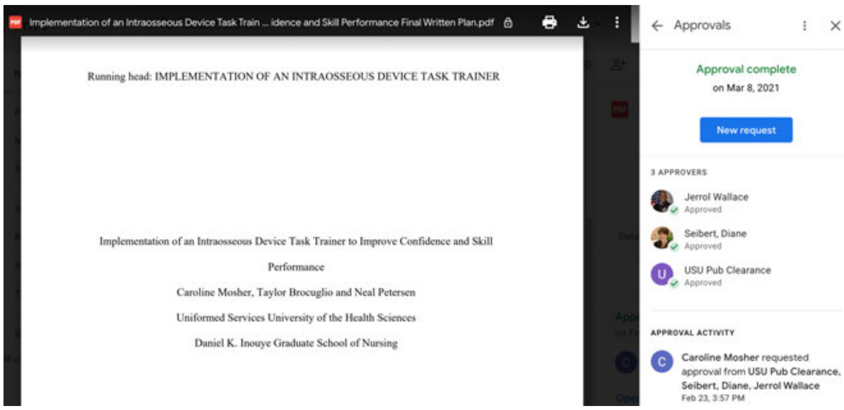
[redacted]

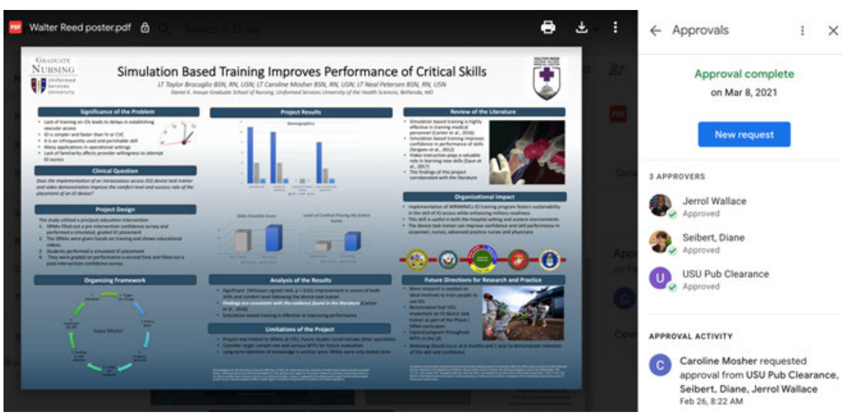
Petrice Longenecker, MA, PhD, CIP
Human Protections Administrator

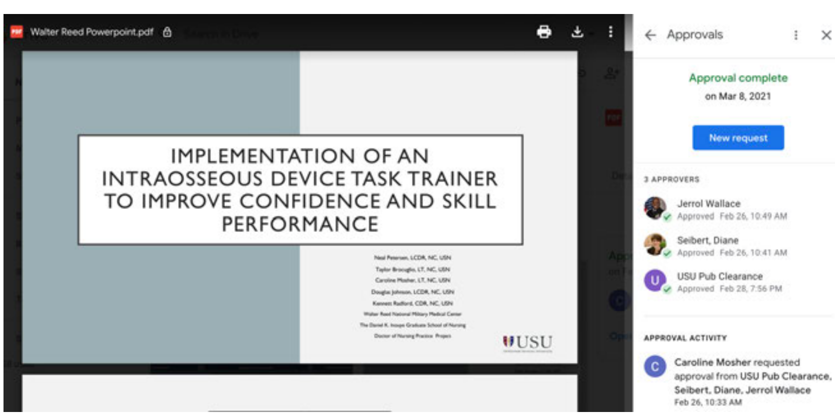
Learning to Care for Those in Harm's Way

Appendix D: PAO Clearance /Level of Dissemination Classification


Appendix F Final.Updated.pdf
Appendix F: Daniel K. Inouye Graduate School of Nursing
Abstract/Impact Statement Form
DOCTOR OF NURSING PRACTICE PROJECT
FINAL REPORT ABSTRACT/IMPACT STATEMENT
ABSTRACT
Phase II Site: Walter Reed National Military Medical Center
Project Title: Implementation of an Intraosseous Device Task Trainer to Improve Confidence and Skill Performance
Authors: Caroline Mosher, Taylor Brocuglio, Neal Petersen
Background: Lack of training, inexperience, and equipment failure can lead to delays in establishing vascular access in adult patients in an emergency. This can cause untimely interruptions to the delivery of emergent interventions. Studies comparing Intraosseous (IO) and central venous access show that IO access is more likely to be successful on the first attempt and takes less time. IO access has been shown to be easier to perform than peripheral venous access during medical emergencies. However, many providers lack confidence and training placing IOs.
Purpose: Improve efficiency in emergency vascular access scenarios utilizing an EBP training
USU Pub Clearance
Approved
APPROVAL ACTIVITY
Caroline Mosher requested approval from USU Pub Clearance, Seibert, Diane, Jerrol Wallace
Mar 1, 3:14 PM
USU Research week
Due Mon, Mar 15, 7:00 PM
Seibert, Diane approved
Mar 1, 3:36 PM
Jerrol Wallace approved
Mar 1, 7:52 PM
USU Pub Clearance approved
Mar 3, 9:56 AM


Implementation of an Intraosseous Device Task Train ... idence and Skill Performance Final Written Plan.pdf
Running head: IMPLEMENTATION OF AN INTRAOSSEOUS DEVICE TASK TRAINER
Implementation of an Intraosseous Device Task Trainer to Improve Confidence and Skill Performance
Caroline Mosher, Taylor Brocuglio and Neal Petersen
Uniformed Services University of the Health Sciences
Daniel K. Inouye Graduate School of Nursing
Approvals
Approval complete
on Mar 8, 2021
New request
3 APPROVERS
Jerrol Wallace
Approved
Seibert, Diane
Approved
USU Pub Clearance
Approved
APPROVAL ACTIVITY
Caroline Mosher requested approval from USU Pub Clearance, Seibert, Diane, Jerrol Wallace
Feb 23, 3:57 PM


Walter Reed poster.pdf
Simulation Based Training Improves Performance of Critical Skills
Approvals
Approval complete
on Mar 8, 2021
New request
3 APPROVERS
Jerrol Wallace
Approved
Seibert, Diane
Approved
USU Pub Clearance
Approved
APPROVAL ACTIVITY
Caroline Mosher requested approval from USU Pub Clearance, Seibert, Diane, Jerrol Wallace
Feb 26, 8:22 AM


Walter Reed Powerpoint.pdf
IMPLEMENTATION OF AN INTRAOSSEOUS DEVICE TASK TRAINER TO IMPROVE CONFIDENCE AND SKILL PERFORMANCE
USU
Approvals
Approval complete
on Mar 8, 2021
New request
3 APPROVERS
Jerrol Wallace
Approved Feb 26, 10:49 AM
Seibert, Diane
Approved Feb 26, 10:41 AM
USU Pub Clearance
Approved Feb 28, 7:56 PM
APPROVAL ACTIVITY
Caroline Mosher requested approval from USU Pub Clearance, Seibert, Diane, Jerrol Wallace
Feb 26, 10:33 AM

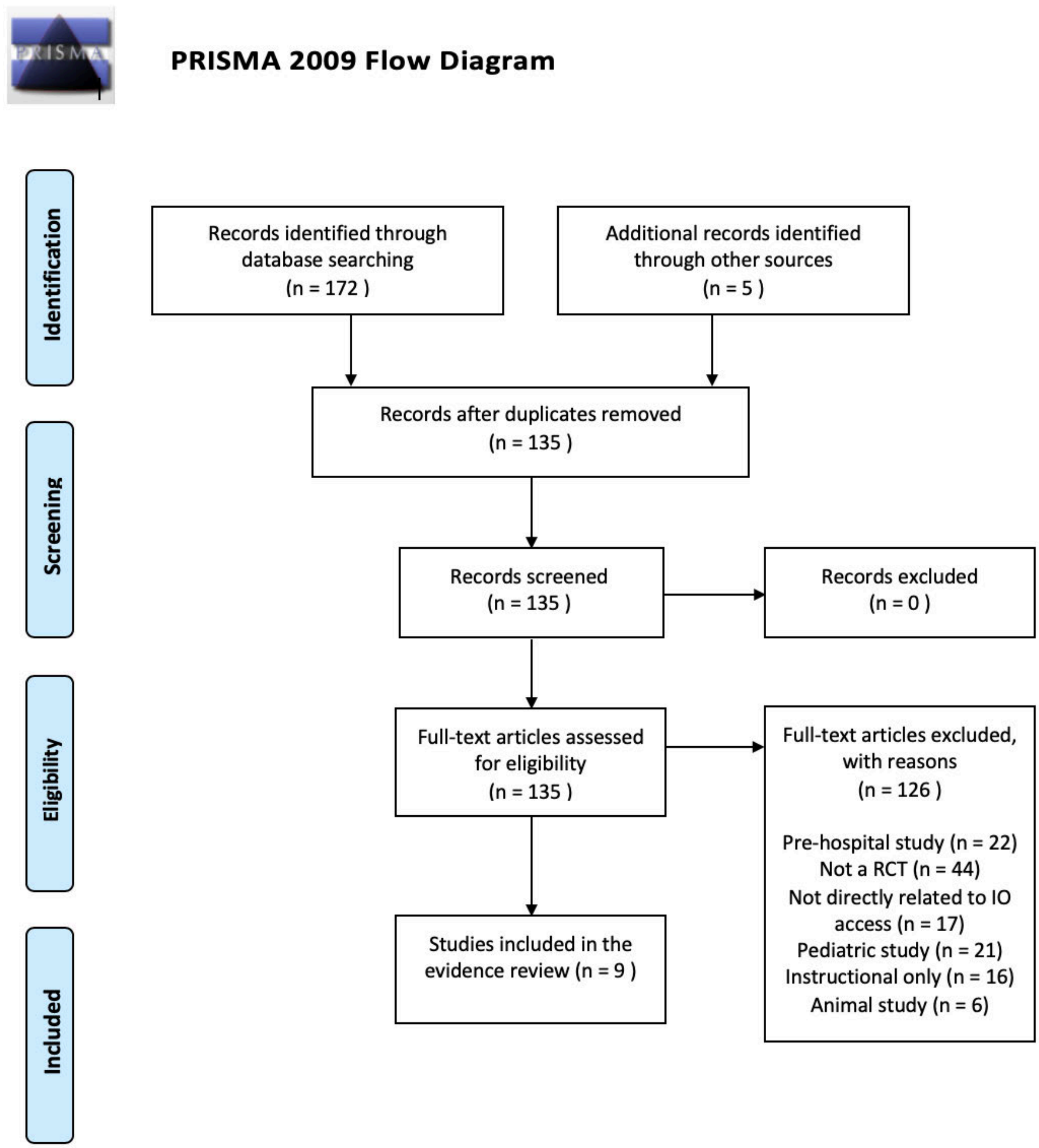
Appendix E: Evidence Table

Study	Study purpose	Independent variables with levels of measurement	Dependent variables with levels of measurement	Statistical test(s) used	Study statistical results	Overall quality of the study per JHNEBP
Simulation training improves ability to manage medical emergencies (controlled, blinded education trial)	Determine the effect of a simulation-based curriculum in emergency medicine on students' abilities to manage emergency situations.	3 day standardized, simulation-based intervention: nominal	Task specific checklists: Nominal	Student's T test	The mean scores were significantly higher in the intervention group as compared to the control group (p<0.0001 to p<0.016).	IB
A Peer-Reviewed Instructional Video is as Effective as a Standardized Recorded Didactic Lecture in Medical Trainees Performing Chest Tube Insertion: A Randomized Control Trial	Determine whether a standardized online procedural video is as effective as a standard recorded didactic teaching session for chest tube insertion	Recorded didactic teaching session, New England Journal of Medicine video: nominal	Questionnaire: Nominal Confidence: Nominal	Student's T test	The NEJM group′s average score was 45.2% (±9.56) on the prequestionnaire, 67.7% (±12.9) for the procedure, and 60.1% (±7.65) on the postquestionnaire. The didactic group′s average score was 42.8% (±10.9) on the prequestionnaire, 73.7% (±9.90) for the procedure, and 46.5% (±7.46) on the postquestionnaire. There was no difference between the groups on the prequestionnaire (Δ + 2.4%; 95% CI: −5.16 to 9.99), or the procedure (Δ −6.0%; 95% CI: −14.6 to 2.65). The NEJM group had better scores on the postquestionnaire (Δ + 11.15%; 95% CI: 3.74-18.6).	IB
Randomized controlled trial of an instructional DVD for clinical skills teaching	Determine the efficacy of clinical skills teaching using a DVD-based teaching medium (interventional group) compared with the traditional, four-step,	DVD based teaching group: nominal Traditional, four step, face to face approach: nominal	Confidence and satisfaction rated using modified Likert scale: Nominal	Unpaired T testing	The interventional group obtained a mean score of 7.56 (SD 1.65) and the control teaching group a mean score of 6.00 (SD 1.84). The mean difference was −1.56 (P < 0.01, 95% CI −2.74 to −0.37). There was no difference in the candidates' perception on the	IB

	face-to-face approach (control group).				satisfaction, anxiety and confidence level about the teaching experience.	
Simulation-based medical education training improves short and long-term competency in, and knowledge of central venous catheter insertion (Before and after intervention study)	Determine whether there is an increase in competency and knowledge with simulation based medical education	1/2-day formal lecture with Hands on Training. Level of Measurement is Nominal	Confidence rated using a standardized multiple-choice questionnaire: Nominal	Student's T test	Thirty-seven residents were included; 18 were tested in the sustainability phase (on average 34 months after training). The average global rating of skills was 23.4 points (+/-SD 4.08) before training, 32.2 (+/-4.51) after training ($P < 0.001$ for comparison with pretraining scores) and 26.5 (+/-5.34) in the sustainability phase ($P = 0.040$ for comparison with pretraining scores). The average hand hygiene compliance score was 2.8 (+/-1.0) points before training, 5.0 (+/-1.04) after training ($P < 0.001$ for comparison with pretraining scores) and 3.7 (+/-1.75) in the sustainability phase ($P = 0.038$ for comparison with pretraining scores). The average checklist compliance was 14.9 points (+/-2.3) before training, 19.9 (+/-1.06) after training ($P < 0.001$ for comparison with pretraining scores) and 17.4 (+/-1.41) ($P = 0.002$ for comparison with pretraining scores). The percentage of correct answers in the multiple-choice questionnaire increased from 76.0% (+/-7.9) before training to 87.7% (+/-4.4) after training ($P < 0.001$).	Level 1B
Online intravenous pump emulator: As effective as face-to-face simulation for training nursing students (mixed method, quasi-experimental design)	Is there a difference in training platforms and successful outcomes	Face-to-face instruction and Online instruction	Confidence rating using Activity Assessment Tool (AAT). Level of measurement is Nominal	Chi-Square Test	No significant differences in learning outcomes, measured by assessment scores out of 80 points, were found between the ONL ($M = 65.5 \pm 9.2$) and ONC ($M = 62.0 \pm 14.8$; $p > .05$) groups. Significantly better learning outcomes were evident for the ONL + ONC group ($M = 68.7 \pm 4.9$) compared to the ONC group ($p < .01$).	Level 1A

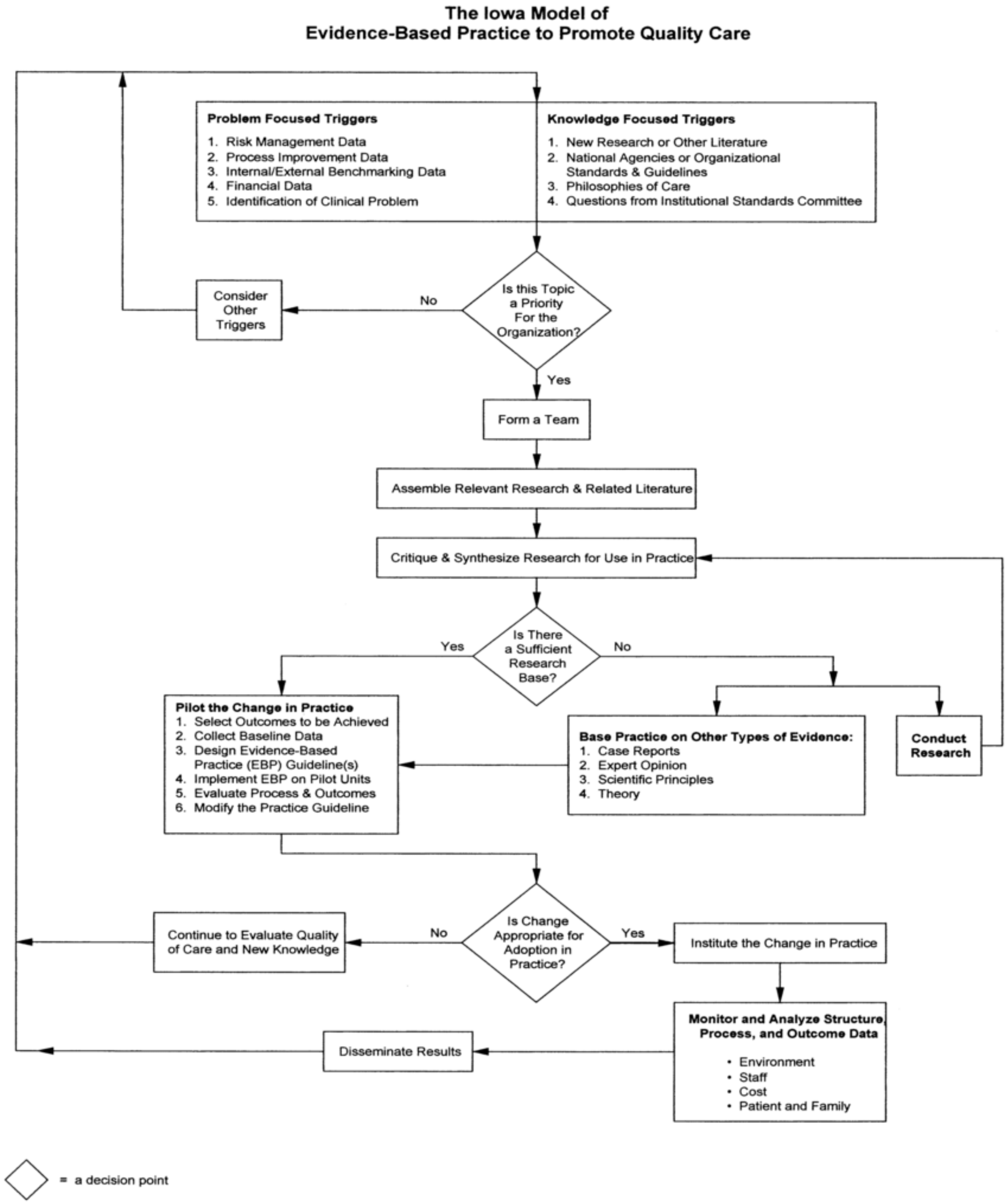
Is the intraosseous access route fast and efficacious compared to conventional central venous catheterization in adult patients under resuscitation in the emergency department? A prospective observational pilot study	To determine whether there is a difference in IO access vs central venous catheter access success on first attempt and time.	IO access and CVC placement: nominal	Success on first attempt and time to placement: Level of measurement is Nominal and Ratio	Mann-Whitney	Success rate on first attempt was 90% for IO vs 60% for CVC. Mean time for IO cannulation was significantly shorter for IO (2.3 + 0.8 min.) vs CVC (9.9 + 3.7 min).	Level 1B
A randomized trial comparing two intraosseous access devices in intrahospital healthcare providers with a focus on retention of knowledge, skill, and self-efficacy	Comparison of two types of intraosseous devices using a standardized training program	EZ-IO, Bone Injection Gun (BIG): nominal	Theory and skills examination: nominal visual analog scale: nominal	Paired t-test	The self-efficacy in responders in using an intraosseous device increased from 22.8 % with no training, to 74.8 % after one training, to 87.9 % after two trainings.	
Proximal Humerus Intraosseous Infusion: A Preferred Emergency Venous Access(prospective cohort study)	To determine what access for the emergent resuscitation of critically ill or injured patients is best.	CV/PIV vs PHIO: nominal	First attempt success rate, (nominal)Mean time to flow, (ratio); mean pain score (ordinal)	Not stated in research article	First attempt success rate 73.7% (PIV); 20% (CVC); 80.6% (PHIO). Mean time to flow in minutes: 3.6 (PIV); 15.6 (CVC); 1.5 (PHIO). Mean pain score for insertion: 0.9 (PIV); Unable (CVC); 4.5 (PHIO). Mean pain score infusion 0 (PIV); Unable (CVC); 3.8 (PHIO). Mean time to good flow is significant	Level 1B

Appendix F: Prisma Diagram



Appendix G: Timeline

Appendix H: The Iowa Model



(Titler et al., 2001)

Appendix I: Pre-intervention Survey

1. What is your branch of service?

- ☐ Army
- ☐ Navy
- ☐ Air Force
- ☐ Public Health

2. Have you had any previous intraosseous access training or experience?

- ☐ Yes
- ☐ No

3. Have you ever placed an IO in the clinical setting?

- ☐ Yes
- ☐ No

4. How many years of critical care experience do you have?

- ☐ <1
- ☐ 1-2
- ☐ 2-5
- ☐ 5+

5. What is your level of comfort in placing Intraosseous Needles?

- ☐ Extremely
- ☐ Very
- ☐ Moderately
- ☐ Slightly
- ☐ Not at all

6. What is your level of comfort locating placement landmarks?

- ☐ Extremely
- ☐ Very
- ☐ Moderately
- ☐ Slightly
- ☐ Not at all

7. How likely would you be to use an IO during an emergency?

- ☐ Extremely
- ☐ Very
- ☐ Moderately
- ☐ Slightly
- ☐ Not at all

Appendix I: Post-intervention Survey

1. What is your level of comfort in placing Intraosseous Needles?

- ☐ Extremely
- ☐ Very
- ☐ Moderately
- ☐ Slightly
- ☐ Not at all

2. What is your level of comfort locating placement landmarks?

- ☐ Extremely
- ☐ Very
- ☐ Moderately
- ☐ Slightly
- ☐ Not at all

3. How likely would you be to use an IO during an emergency?

- ☐ Extremely
- ☐ Very
- ☐ Moderately
- ☐ Slightly
- ☐ Not at all

4. Would you be more likely to place an IO in an emergency setting following this training?

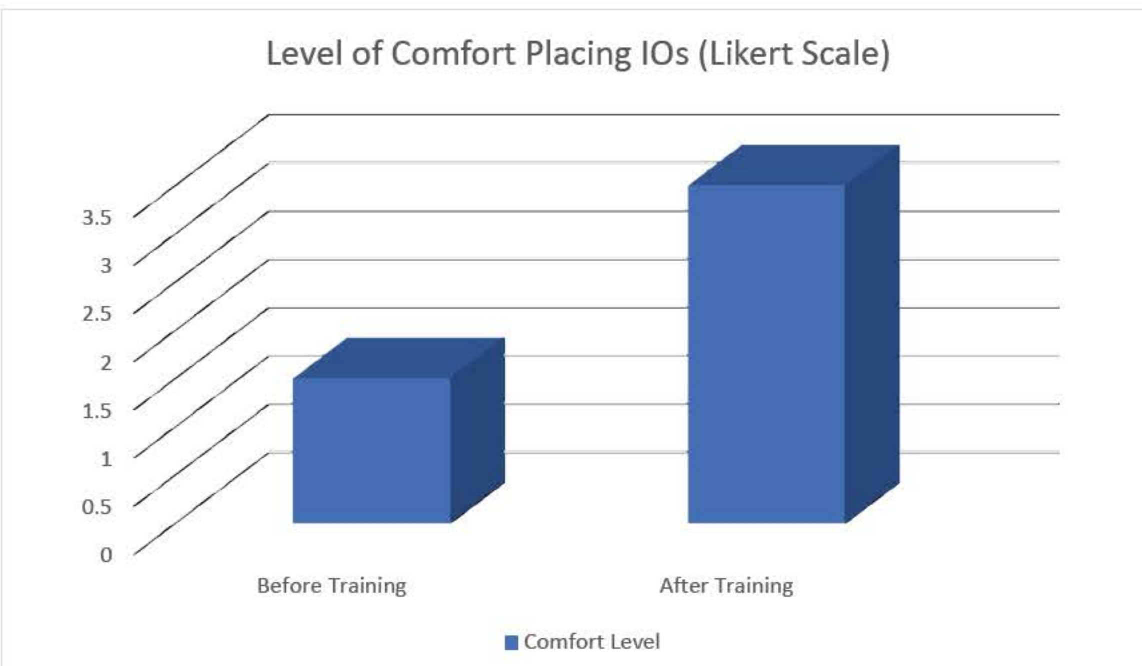
- ☐ Extremely
- ☐ Very
- ☐ Moderately
- ☐ Slightly
- ☐ Not at all

Appendix J: Procedural checklist for Intraosseous Needle placement

(Afzali, Kvisselgaard, Lyngeraa, & Viggers, 2017)

Topical antiseptic	
Not used	0
Used on the puncture site	1
Gloves	
Not used	0
Gloves used	1
Insertion technique	
Skin penetration with needle while drilling	0
Skin penetration with needle placed on the machine without drilling	1
Further insertion of IO needle with discontinued drilling until loss of resistance	0
Further insertion of IO needle with continuous drilling until loss of resistance	2
Fluid aspiration from marrow cavity with an empty syringe	
Absence of aspiration	0
Aspiration of fluid	2
Infusion of 0,9% NaCl	
Absence of infusion of 0,9% NaCl	0
Infusion of 0,9% NaCl	2
Securing the line	
No further securing of IO line	0
Use of dedicated stabilizer and/or other fixation to secure the line	1
Location of the puncture site (observed after insertion)	
Outside the puncture site or mobile needle	0
On the puncture site +/− 0,5 cm	3
Angle of insertion (observed after insertion)	
Oblique insertion	0
Perpendicular insertion +/− 10°	2
Total Score	
I.O access functioning	Yes
	No

Appendix K: Project Results



Appendix L: Completion Verification Form

Appendix G: Daniel K. Inouye Graduate School of Nursing
DNP Project Completion Verification Form

DOCTOR OF NURSING PRACTICE PROJECT
Completion Verification Form

The DNP Project titled: Implementation of an Intraosseous Device Task Trainer to Improve Confidence and Skill Performance was completed at Walter Reed National Military Medical Center by the following student(s):

LT Taylor Brocuglio [redacted] 12/6/20
LCDR Neal Petersen 2/17/21
LT Caroline Mosher 12/5/20

The DNP Practice Project Team verifies that the following components of the DNP project, accomplished by the above students, is of sufficient rigor and demonstrates doctoral level scholarship to meet the requirements for USUHS GSN graduation:

- Presentation of DNP project to the leadership/stakeholders at the Phase II Site,
- Abstract/Impact Statement (*Appendix F*), and
- DNP Project written report.

Verified by:

LCDR Douglas Johnso[redacted] 2/23/21 Senior Mentor

LCDR Douglas Johnso 2/23/21 Team Mentor & Phase II Site Director

For RNA Students only *- add the following additional signature for final verification of project completion:*

CDR Ken Radford [redacted] 8 Mar 2021
RNA Project Director *(Signature)* *(Date)*

Form Version: 26 Aug 2017