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I. Specific Educational Aims:

Successful treatment of a patient with a distal radius fracture is an essential skill for the practice of emergency physicians and orthopedic surgeons, yet, the graduating emergency physician may have had minimal opportunities to perform reductions as a resident. We aim to rectify this issue by creating a “mastery learning” curriculum for distal radius fractures to improve EM and orthopedic resident competence for this procedure. Simulation based mastery learning is a type of intensive coursework for procedural learning that has been shown to improve learning and decrease complication rates for certain procedures (Barsuk, 2009). Our aims are as follows:

- 1) Develop a mastery learning curriculum for distal radius fractures.
- 2) Develop a hi-fidelity, 3D printed distal radius fracture simulator.
- 3) Implement the curriculum and evaluate the success of the curriculum with regards to individual education for PGY-1 EM and Orthopedic residents.
- 4) Determine the strength of an association between improved knowledge or competence and trends in treatments of distal radius fractures in the Stanford ED.

Of the TMA funding priorities, our grant would apply to: *collaboration* between EM and Orthopedic Surgery, with curriculum and checklist input from both specialties, training for both groups of residents, and outcomes that evaluate care for shared patients; rigorous approaches to education *innovation*, including multidisciplinary standards setting exercises, creation of a novel 3D printed simulator, and iterative evaluation of curriculum and learning, and *sustainability* regarding yearly and just-in-time training for successive classes of residents.

II. Project Rationale:

Currently, learning the reduction of a distal radius fracture proceeds as with many procedures, in a “see one, do one, teach one” fashion at the bedside with a senior practitioner. Learning can be limited by supervisor experience and teaching ability. Prior research shows both dissatisfaction with musculoskeletal training and deficiencies in musculoskeletal knowledge amongst emergency physicians (Comer, 2014). Survey data collected for this project from EM residents revealed decreased comfort with physical reduction techniques and fracture manipulation compared to other parts of the distal radius fracture reduction procedure (physical examination, radiograph review, post-splint check, etc), but a desire to improve competence.

While at least one other simulator for distal radius fractures exists, it does not have accompanying curriculum and requires purchase of expensive industrially produced bones (Seeley, 2017). This research does validate the idea that a fracture simulator adequately models clinical care. Our 3D printed model is easily reproducible and replaceable, and can be adapted for different fracture reduction difficulties. We are also designing the simulator to be used with a mastery learning curriculum that optimizes learning of the basic steps of the procedure, which has not been developed or studied yet in the literature. We hypothesize that the combination of a simulation based curriculum and hi-fidelity simulator will improve learning for this important procedure and change how residents care for patients presenting with a distal radius fracture.

III. Approach:

We have developed a preliminary pre-session curriculum that has been reviewed by orthopedic and EM physicians from multiple institutions. We will develop this curriculum into an interactive online module for asynchronous completion prior to the mastery learning session. This knowledge will be tested with a pre-session quiz. Mastery of the procedure will then be evaluated by perfect completion of the procedure multiple times as judged by a trained supervisor with a checklist. This checklist has also been developed, with plans for a multidisciplinary standard setting exercise to confirm that the checklist represents adequate procedural excellence.

IV. Timeline and plan for implementation:

June/July 2019- Standard setting; mastery learning course attendance; prototype iteration

August 2019-March 2020- Mastery learning sessions

March 2020 - Data collection and analysis, extra workshops

April 2020- Poster Preparation

May 2020- Presentation SAEM, TMA Lecture

V. Anticipated Work Product:

At the end of the grant period and with the assistance of the grant fundings, we will have rigorously developed a much needed mastery learning curriculum for the management of the distal radius fracture and a hi-fidelity and cheap model for simulation. We will study both knowledge gained through the use of these materials as well as resident behavior regarding this common presentation to the ED. Ideally, we can contribute evidence to the hypothesis that improving procedural knowledge and competence changes resident behavior in a way that improves patient care. The interdisciplinary educational approach to a shared patient presentation will also be important in improving education and the practice environment for all participants.

VI. Evaluation Plan:

To determine success of the simulator, we will evaluate both the mastery learning session and subsequent changes in resident behavior. Evaluating the teaching session will include successful completion of the curriculum, pre-test, and monitored completion of the procedure using the checklist as well as resident feedback. Much of opportunity in medical training comes from trainee confidence- therefore, resident attitudes surrounding reduction of distal radius fracture may be enlightening. Pre and post-session surveys could be used to ascertain levels of comfort with the procedure and willingness to complete it without direct orthopedic involvement. However, having each resident pass the tests and feel more confident does not necessarily mean that ability or competence has improved. Therefore, we will monitor trainees who go through this course using a variety of parameters, including distal radius fractures logged by EM residents and number of adequately reduced distal radius fractures in the ED that did not include orthopedic surgery involvement.

VII. Dissemination of Results:

Dissemination will proceed locally via a presentation at one of the Teaching and Mentoring Academy lectures. We will plan to present the outcome of the project at the SAEM national conference in 2020. Furthermore, we believe that the successful completion of this project will result in a publication in a medical education journal such as AEM Education and Training.

References

Barsuk J, Cohen E, Feinglass J, McGahie W, Wayne D. *Use of simulation-based education to reduce catheter-related bloodstream infections*. Arch Intern Med. Vol 169 (No. 15) Aug 2009.

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