2021-05-20

Musculoskeletal Injuries in the Austere Setting: A Pilot Training for Student Nurses

Diego H. González
emaildiegogonzalez@gmail.com

Musculoskeletal Injuries in the Austere Setting:

A Pilot Training for Student Nurses

Diego H. González

A project submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Science

Craig Nuttall, Chair
Scott Summers
Blaine Winters

College of Nursing

Brigham Young University

ABSTRACT

Musculoskeletal Injuries in the Austere Setting:
A Pilot Training for Student Nurses

Diego H. González
College of Nursing, BYU
Master of Science

Registered Nurses (RNs) make up the largest proportion of healthcare workers in the United States. As such, RNs are frequently involved in responding to emergencies in austere settings such as natural disasters and wilderness environments. Many injuries in the austere setting are categorized as musculoskeletal. Currently, nursing programs do not provide any curricular training on austere medicine. This leaves nurses unprepared to face the challenge of responding to emergencies in the austere environment.

Purpose: Create and pilot test an effective training for a nursing program at a private university in the Western United States on musculoskeletal injuries in the austere setting through online modules and simulation scenarios.

Methods: An online learning module on musculoskeletal injuries in the austere setting was developed and administered to nursing students.

Outcomes: Participating nursing students completed a pre- and post-test questionnaire which indicates the learning module improved their knowledge of musculoskeletal injuries in the austere setting.

Conclusion: The online learning module is effective at improving participant knowledge on musculoskeletal injuries in the austere setting. Future implementation will include field training simulations and will be incorporated into a comprehensive austere medicine course named "Wilderness RN."

TABLE OF CONTENTS

Musculoskeletal Injuries in the Austere Setting: A Pilot Training for Student Nurses

The United States (US) has experienced an increase in the number of natural disasters and extreme weather events over the last 40 years (National Oceanic and Atmospheric Administration [NOAA], 2019). These disasters have resulted in billions of dollars lost and millions of lives affected (NOAA, 2019). The US has seen over 5,000 deaths (NOAA, 2019) and more than 26,000 injuries stemming from weather-related disasters within the past ten years (National Weather Service, 2018).

The portion of US residents who engage in outdoor activities continues to grow. Almost half of Americans engage in at least one outdoor activity each year (Outdoor Industry Association, 2018). As more people participate in outdoor activities, there is an increase in the number of injuries from these activities (Flores et al., 2008). Many injuries experienced in the austere settings (resource limited environments including the wilderness and disaster settings) are musculoskeletal injuries. The 2014 statistics on the incidence of musculoskeletal injuries in the US show that these injuries account for an estimated 77.4% of all reported injuries (Pollak & Watkins-Castillo, 2014). With this high rate of occurrence, there is evidence of the critical importance of healthcare professionals being appropriately trained on how to respond, treat, and manage musculoskeletal injuries in the austere setting.

As the most predominant profession among healthcare workers, registered nurses (RN's) are frequently involved in responding to natural disasters and outdoor emergencies. However, nursing programs do not currently include austere medicine education in their curricula (Achora & Kamanyire, 2016). This leaves nurses unprepared to face the challenges presented in the austere setting, including caring for musculoskeletal injuries.

Results from a cross-sectional survey identify a lack of general disaster nursing knowledge among nurses (Sonneborn et al., 2018). A recent systematic review of literature on the subject suggests that despite the increasing number of initiatives to prepare nurses for disasters, nurses are still under-prepared for responding to disasters (Labrague et al., 2018). Nurse training programs seem to inadequately address the need for further disaster-related preparation. However, implementation of training in this area tends to enhance confidence and self-efficacy related to treating these types of injuries (Born et al., 2012). Furthermore, research demonstrates that training individuals on how to proceed in emergencies increases their willingness and propensity to respond when needed (Oliver et al., 2014).

Effective austere medicine training for nurses can be accomplished by combining online learning modules and experiential learning, such as simulations. Learning modules and simulation scenarios have been reported by nurses, students, and faculty to improve the educational experience (McKinney et al., 2016). A study on nurses who completed a computer-based online module demonstrated a significant knowledge increase after completing the module irrespective of the nurse's background and experience (Schneiderman et al., 2009). Additionally, students report that completing an online module supports and facilitates their performance during a simulation applying module material (Lupi et al., 2016). A meta-analysis reports significant improvements for learners who received simulation education contrasted with those in control groups; study participants were learning clinical subjects and were either nurses or senior undergraduate nursing students (Shin et al., 2015). Using simulation scenarios for learning the care of musculoskeletal injuries in the austere setting may have a large impact on the students participating in this education module.

The purpose of this project was to create and pilot test an effective training for a nursing program at a private university in the Western United States on musculoskeletal injuries in the austere setting through an online learning module followed by simulation scenarios.

Methods

This project was divided into three phases: development, implementation, and evaluation. This project was exempt from Institutional Review Board approval.

Development

The development phase involved creating an online module, designing a pre- and post-test questionnaire, and planning simulation scenarios. An online learning module focusing on the four most common types of musculoskeletal injuries in the austere setting (i.e., strains, sprains, fractures, and dislocations) was developed for implementation with undergraduate nursing students.

The content taught in the module was obtained from different wilderness medicine textbooks including *Auerbach Wilderness Medicine, Field Guide to Wilderness Medicine, NOLS Wilderness Medicine*, *Wilderness and Travel Medicine* (Auerbach et al., 2017; Auerbach et al., 2003; Schimelpfenig & Safford, 2012; Weiss & Weiss, 2012).

The online module features a Microsoft PowerPoint presentation, accompanying video recording of the instructor, and skill demonstration videos. The module was recorded using Loom software with a final run time of 57 minutes. In the module, each of the four common musculoskeletal injuries and recommended treatments were defined. These topics provide a broad base of knowledge and skills to help participants be confident and competent in their approach of musculoskeletal injuries in the austere setting. After creation, the module was submitted to a panel of three expert reviewers who provided feedback to improve future

participant experience. There were two overarching themes in the experts' input of the module: (1) consider having the content in smaller video segments rather than one longer video; and (2) consider having a formalized script to aid in the video's flow. The experts reported that the content of the module was appropriate for the purpose of the project.

A pre-test was created to evaluate participants' prior knowledge on the subject. The questionnaire consisted of 12 items and was to be administered immediately preceding the students' online module participation. These items included 11 multiple choice questions and one true/false question. This same questionnaire was utilized as a post-test after the module completion to assess the students' learning progress. The questionnaire covered key concepts for each of the four types of musculoskeletal injuries in the austere setting (e.g., injury assessment, treatment, and decision-making). In addition to the 12-item questionnaire, the post-test included eight qualitative questions to obtain student feedback.

The final part of the development phase involved the planning and organization of musculoskeletal injury-focused simulation scenarios aligned with the material previously taught to the students during the online learning module. The scenarios were meant to provide the opportunity for students to practice the principles and skills taught throughout the online learning module. The simulation scenarios were to be delivered in-person during a field training experience that would take place in September of 2020.

Implementation

The implementation phase encompassed three key steps. In step one, nursing students interested in participating in the course were recruited, and instructions were provided to inform them about the training process, expectations, and timeline. An invitation to participate in the training was sent out to 63 fourth-semester, undergraduate nursing students

from a nursing program at a private university in the Western United States. No financial or other manner of compensation was offered to the participants.

The second step was administering the pre-test, online learning module, and post-test using Loom learning software. Fourteen students completed the pre-test and had access to the online learning module. A total of eight students participated in the pre-test, online learning module, and post-test.

The third step was the field training experience with the students. This experience was meant to (1) help solidify the students' knowledge and understanding regarding musculoskeletal injuries and (2) provide an opportunity to practice and apply the principles learned in a safe and controlled environment. However, administration of the simulation scenarios in a field training experience was not possible due to COVID-19 pandemic restrictions.

Evaluation

By the completion of this course, students met the following objectives: (1) identify and differentiate the most common musculoskeletal injuries taking place in the austere setting; (2) create a plan of care/treatment based on the assessed injuries and resources; (3) provide adequate treatment based on the plan to optimize outcomes for the injured victims; (4) gain confidence in their role of healthcare responder in austere setting emergencies.

Students were evaluated using two different methods to ensure they gained adequate knowledge and skills through the course, thus meeting the learning objectives. The first method of evaluation took place through the pre- and post-test questionnaires administered at the beginning and end of the online learning module. Student test results were scored and analyzed to evaluate training effectiveness. The second evaluation method was to take place during the field training experience. During this experience, the students were to be observed as they

applied their newly acquired knowledge in practical simulation scenarios. At this time, individual

feedback and coaching were to be provided as needed to help them consolidate their learning

experience. However, this second evaluation method was not carried out due to COVID-19

pandemic regulations restricting any type of field training experience.

Dissemination

This online learning module on musculoskeletal injuries will be combined with training

in other areas of wilderness medicine. The resulting combined training course is called the

"Wilderness RN" course and will be taught in the Fall of 2021 to a new group of nursing student

participants. Following Fall 2021 instruction, this combined course will be submitted for

certification for continuing education credits through the Emergency Nurses Association.

Results

Pilot Testing Online Learning Module

Eight students participated in the pre-test, online learning module, and post-test. There

was no demographic or identifiable information collected on the student participants.

The pre-and post-test scores for the participants were compared using a paired t-test

analysis. The students had a mean score of 44% (SD = 0.124) for the pre-test; the mean score

improved to 70% (SD = 0.166) in the post-test. This analysis revealed that nursing students' test

scores improved significantly after participating in the online module (t score = -3.851, P =

0.0063). A visual comparison of the pre-test vs. post-test scores can be seen in Figure 1.

Figure 1
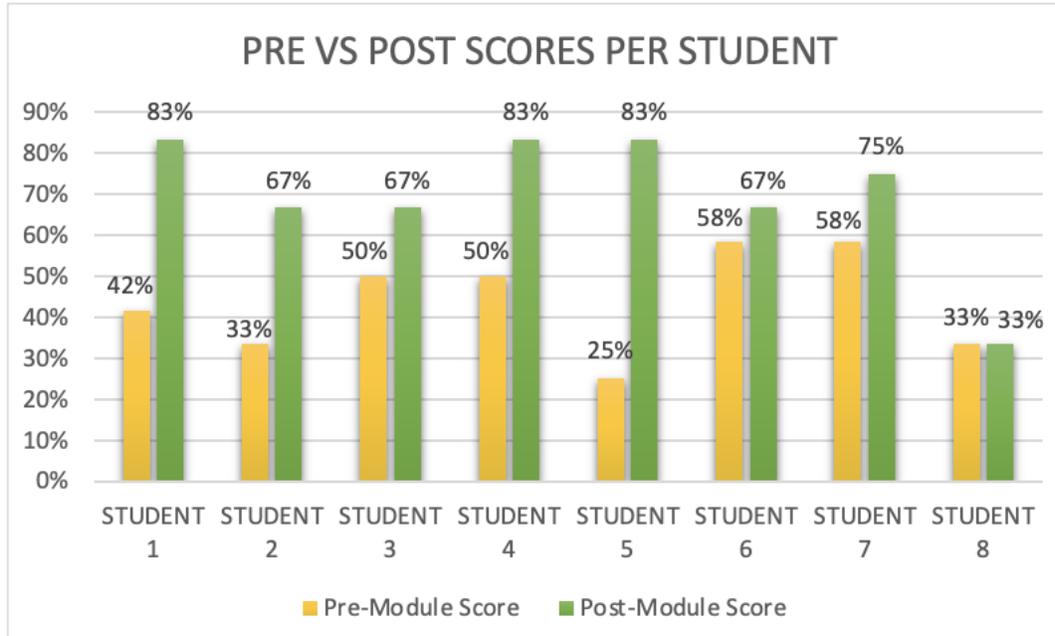
Likert Scale Survey Questions

As part of the post-test, participants were asked to provide qualitative feedback on the module. Using a Likert-type scale (Table 1), the participants were asked how much they felt they had learned from this training. Their responses to this question align with the improvement in the participants' scores. Seventy-five percent of the students rated their perceived learning by selecting the top two Likert-type scale choices—"a great deal" and "a lot." The remaining 25% of participants felt that they learned "a moderate amount." Another question asked the participants to rate how well the learning module met their expectations; 62.5% of the participants expressed the training met their expectations either "very well" or "extremely well," the remaining 37.5% chose "moderately well" as their response.

Table 1

Likert Scale Survey Questions

Question	Scale Options
How much did you learn from this training?	5-point scale. Nothing at all, a little, a moderate amount, a lot, a great deal.
How well did this training meet your expectations?	5-point scale. Not well at all, slightly well, moderately well, very well, extremely well.
How comfortable do you feel caring for musculoskeletal injuries in the austere setting?	7-point scale. Extremely uncomfortable, Moderately uncomfortable, slightly uncomfortable, neither comfortable or uncomfortable, slightly comfortable, moderately comfortable, extremely comfortable.

Using a seven-point Likert scale, the participants were asked to rate how comfortable they felt taking care of musculoskeletal injuries in austere environments. The majority of participants felt either "moderately comfortable" or "slightly comfortable" after watching the online module; only one participant chose "neither comfortable nor uncomfortable" in response to this question (Figure 2). Additionally, participant comments indicated they would have "loved to try out the techniques in person."

Figure 2
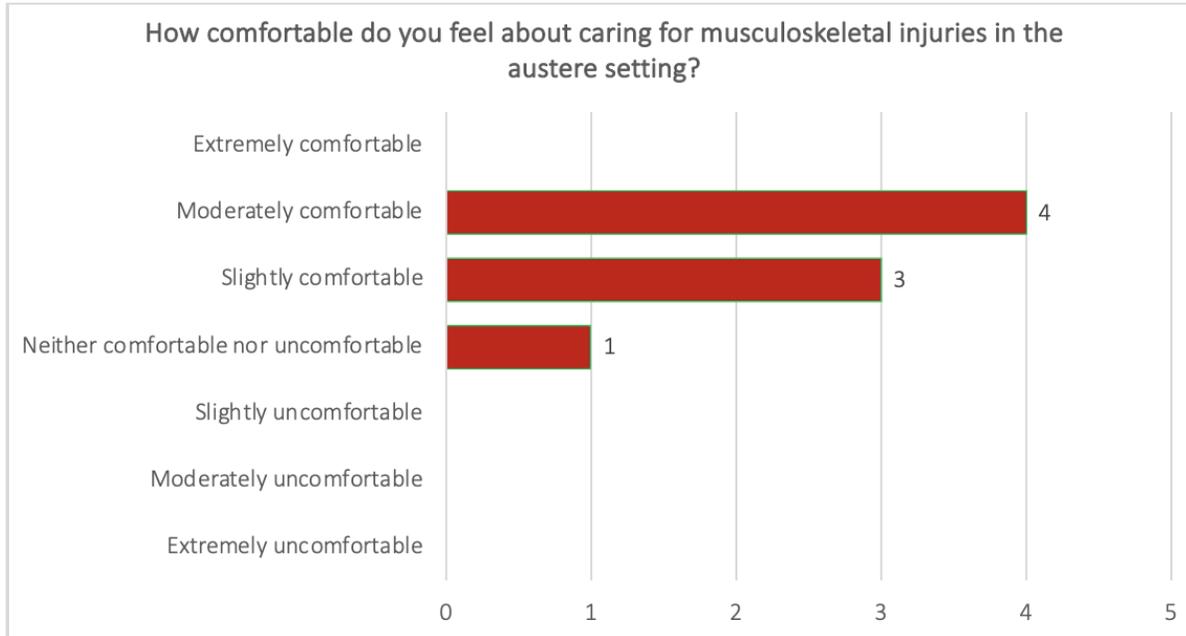
Comment Themes

Four qualitative questions allowed the participants to provide additional feedback in open-ended form. All eight participants were asked, "What did you enjoy about this training?" The common theme identified in their responses was that participants appreciated the practicality of the information they were receiving (n = 4). One participant noted, "very applicable. I love hiking and being outdoors, so I feel a lot more prepared now if any of my friends hurt themselves while outside away from help."

The next question asked, "What, if anything, would you remove from the training?" A predominant theme in the participants' responses was that they would not remove anything (n = 6). There was one participant who suggested removing "transition slides that serve no purpose," which may be referring to the transitions between the slideshow and video technique demonstrations, and another participant stated they would prefer to "take out the text on slides."

Another question asked participants, "How would you improve this training?" The answers to this question were varied but fall into three themes: (1) content (n = 3); (2) training format and delivery (n = 3); and (3) other (n = 2). In the content theme, one participant stated, "more demonstrations, those were very helpful!" Regarding the second theme, a participant noted, "make sure the circle with [the speaker] in it isn't covering up any text or photographs." In the third theme, one student answered, "I thought it was great!"

The fourth open-ended question asked students, "What, if anything, would you like to see more of in the education module? Would you prefer any specific topic to be covered more in-depth?" The common theme identified was students' expression of satisfaction with the topics covered (n = 3)—these participants did not have requests to add any new information to the module. The remaining responses could be categorized into the areas of (1) assessment and interventions (n = 4); and (2) training in other injury types (n = 1). In the first area, a student said, "one topic I would cover more would be how to improvise more objects for splinting or immobilizing." For the second area, the student answered that they would like to know more about "injuries such as animal attacks, bites, stings, etc."

There was one multiple choice question asking participants, "Do you prefer shorter segmented presentation videos (three 20-min segments, e.g.) rather than the one-hour training video presentation?" The overarching theme was that most participants felt that a one-hour training was "fine" (n = 5); others thought they preferred shorter video segments (n = 3).

Discussion

Our paired t-test analysis comparing the pre-test with the post-test results yielded a t-score of -3.851 and a p-value of 0.0063, suggesting that our learning module effectively improved the knowledge base of the participants on musculoskeletal injury care in the austere

environment. On average, the students improved their score on the test by 26% after completing the online learning module, with students improving their score as much as 58%. The average score of the pre-test was 44%. Although not conclusive, this pre-test score is evidence that nursing students lack knowledge about musculoskeletal injuries in the austere environment. The average score improving to 70% confirms that this learning module was an effective first step in educating student nurses in austere medicine.

The results of the pilot test show that the online module was effective in improving participant knowledge regarding musculoskeletal injuries. The pilot study results also indicated that the online module improved their confidence in caring for someone with this type of injury. Unfortunately, we were unable to incorporate the simulation experience into this project due to COVID-19 restrictions. It would be interesting to compare a participant's perceived confidence level with their live performance during a simulation scenario. In addition to increased confidence, participants appeared satisfied with their learning experience. Several students manifested, "learning a lot of information," "enjoying the videos and photos," and "liking the way the training was presented."

Modifications to Online Learning Module

The online learning module has been modified to improve participant experience and learning. In the modification process, the feedback from the expert reviewers and student participants was carefully considered. Changes that were determined beneficial to the general target audience were implemented on a new module recording. These modifications include the following:

1. The instructor's video has been moved to a corner that is visible but does not overlap any of the text in the slideshow.

2. The online module was rerecorded in six segments organized by topic and chronology; the segments can be watched individually or together as one larger module.

3. A detailed script was created and implemented in the rerecorded module.

4. The slideshow was revised, and changes were made to reduce wordiness and increase viewability for the general target audience.

Project Limitations

By nature, learning musculoskeletal injury care involves hands-on practice. Considering participant comments, many felt like they would have benefitted from a hands-on training session to complement their online module experience. The original plan was to have the online learning module for the student nurses coupled with a hands-on field training experience. The concept was to apply the skills taught in the module and consolidate the participant's learning experience. However, due to COVID-19 virus pandemic restrictions, we could not implement a field training experience with associated simulation scenarios. Even though we were unable to offer the participants a field training experience, the post-test showed the nursing students now felt more comfortable approaching the care of musculoskeletal injuries in the austere setting. We believe the field experience would have improved upon the results seen using the online learning module alone. We also feel that a mixed training modality—online module and field experience—offers a higher appeal to prospective nursing student participants.

Besides limitations imposed by the COVID-19 pandemic, we experienced another constraint: we had a limited number of participants. Invitations to participate in this training were sent out to 63 nursing students. Out of the 63, 14 nursing students started the training and completed the pre-test. However, only eight of those 14 students completed the learning module

and the post-test. In future iterations of this training, a higher number of participants would be

beneficial in evaluating and improving of the module.

Another limitation noted is the population used to pilot this module. All 14 participants

were undergraduate nursing students in their fourth semester of nursing school. Future training

will likely include students that are closer to graduation. The pilot project results show that

fourth-semester nursing students' knowledge of musculoskeletal injuries improved but does not

fully provide evidence that this module will also improve the knowledge of more experienced

nursing students.

Future Iterations

Further planning and implementation of a field training experience—including simulation

scenarios—coupled with the online learning module would be recommended during the next

iteration of this training. Considering the training's future delivery, the nursing student

participants and expert reviewers provided feedback on what they thought about the online

learning module. Based on the input, a new version of the online learning module was created.

With the field training experience, this updated version of the online module is recommended for

utilization with the next group of nursing student participants.

The current plan is to have the updated musculoskeletal injury training module added to a

training course that includes other subjects in the area of wilderness/austere medicine. The

comprehensive training program—which will include the musculoskeletal injury training as one

of its modules—will be called the "Wilderness RN" course and will be piloted in the Fall of

2021 with student nurse participants. After program instruction in the Fall, course accreditation

will be sought from the Emergency Nurses Association to make the wilderness RN course an

official ENA certification program for nurses.

Conclusion

The purpose of this project was to create and pilot test an effective training for a nursing program at a private university in the Western United States on musculoskeletal injuries in the austere setting through online modules followed by simulation scenarios. An online learning module was developed and delivered to a participating group of nursing students. Due to COVID-19 pandemic restrictions, we were unable to administer field training simulation scenarios for the participants. A pre-test and post-test were administered to the participants before and after the online learning module, respectively. The test results were statistically significant, with participants improving their test scores from 44% to 70% on average. Future implementation of this training will include the updated version of the online learning module and field training simulation scenarios to enhance the learning experience. The updated training module will be incorporated into a comprehensive austere medicine training for student nurses to be called the "Wilderness RN" course.

References

Achora, S., & Kamanyire, J. K. (2016). Disaster preparedness: Need for inclusion in
undergraduate nursing education. *Sultan Qaboos University Medical Journal, 16*(1), 15.
doi:10.18295/squmj.2016.16.01.004

Auerbach, P. S., Cushing, T. A., & Harris, N. S. (2017). *Auerbach's wilderness medicine*
(seventh, Vol. 2). Elsevier.

Auerbach, P. S., Donner, H. J., & Weiss, E. A. (2003). *Field guide to wilderness medicine*.
Mosby.

Born, K., Orkin, A., VanderBurgh, D., & Beardy, J. (2012). Teaching wilderness first aid in a
remote first nations community: The story of the sachigo lake wilderness emergency
response education initiative. *International Journal of Circumpolar Health, 71*(1), 19002-7.
doi:10.3402/ijch.v71i0.19002

Flores, A. H., Haileyesus, T., & Greenspan, A. I. (2008). National estimates of outdoor
recreational injuries treated in emergency departments, united states, 2004–
2005. *Wilderness & Environmental Medicine, 19*(2), 91-98. doi:10.1580/07-WEME-OR-
152.1

Labrague, L. J., Hammad, K., Gloe, D. S., McEnroe-Petitte, D. M., Fronda, D. C., Obeidat, A.
A., . . . Mirafuentes, E. C. (2018). Disaster preparedness among nurses: A systematic review
of literature. *International Nursing Review, 65*(1), 41-53. doi:10.1111/inr.12369

Lupi, C., Ward-Peterson, M., & Chang, W. (2016). Advancing non-directive pregnancy options
counseling skills: A pilot study on the use of blended learning with an online module and
simulation. *Contraception, 94*(4), 348-352. doi:10.1016/j.contraception.2016.03.005

McKinney, S. H., Tavakoli, A., & Herman, J. (2016). PsyConnect: Constructing layered

engagement for optimal learning in clinical education. *The Journal of Nursing*

Education, 55(9), 541-543. doi:10.3928/01484834-20160816-10

National Oceanic and Atmospheric Administration. (2019). *Billion-dollar weather and climate*

disasters: Overview. https://ncdc.noaa.gov/billions/

National Weather Service. (2018). *Summary of natural hazard statistics for 2018 in the United*

States. weather.gov/media/hazstat/sum18.pdf

Oliver, E., Cooper, J., & McKinney, D. (2014). Can first aid training encourage individuals'

propensity to act in an emergency situation? A pilot study. *Emergency Medicine*

Journal, 31(6), 518-520. doi:10.1136/emermed-2012-202191

Outdoor Industry Association. (2018). *2018 outdoor participation report.*

https://outdoorindustry.org/resource/2018-outdoor-participation-report/

Pollak, A. N., & Watkins-Castillo, S. E. (2014). *United states bone and joint initiative: The*

burden of musculoskeletal diseases in the united states (BMUS), fourth edition. ().

Rosemont, IL: Retrieved from https://www.boneandjointburden.org/2014-

report/via20/incidence-musculoskeletal-injuries

Schimelpfenig, T., & Safford, J. M. (2012). *Nols wilderness medicine* (fifth). Stackpole Books.

Schneiderman, J., Corbridge, S., & Zerwic, J. J. (2009). Demonstrating the effectiveness of an

online, computer-based learning module for arterial blood gas analysis. *Clinical Nurse*

Specialist, 23(3), 151-155. doi:10.1097/NUR.0b013e3181a075bc

Shin, S., Park, J., & Kim, J. (2015). Effectiveness of patient simulation in nursing education:

Meta-analysis. *Nurse Education Today, 35*(1), 176-182. doi:10.1016/j.nedt.2014.09.009

Sonneborn, O., Miller, C., Head, L., & Cross, R. (2018). Disaster education and preparedness in

the acute care setting: A cross sectional survey of operating theatre nurse's disaster

knowledge and education. *Nurse Education Today, 65*, 23-29.

doi:10.1016/j.nedt.2018.02.015

Weiss, E. A., & Weiss, E. A. (2012). *Wilderness & travel medicine: A comprehensive guide*

(fourth). Mountaineers Books.