

Garrison, C. M., Ritter, F. E., Weyhrauch, P., Niehaus, J., & Bauchwitz, B. (accepted). A computer-based tutor to teach nursing trauma care that works as an adjunct to high fidelity simulation. Abstract accepted for podium and poster presentation at the International Meeting on Simulation in Healthcare, January 2019, San Antonio, TX.

Will also appear as:

Garrison, C. M., Ritter, F. E., Weyhrauch, P., Niehaus, J., & Bauchwitz, B. (in press). A computer-based tutor to teach nursing trauma care that works as an adjunct to high fidelity simulation. *Simulation in Healthcare*.

## **Hypothesis/Research Questions**

Educators are challenged to prepare nurses to care for low volume, high acuity clinical problems such as trauma. It is difficult to provide learners with hands-on practice without compromising the quality of care, and the lack of opportunity for hands-on clinical practice creates a need for alternate learning approaches. The use of high-fidelity manikin simulators in nursing education is well-accepted and supported by literature<sup>2,3</sup>, but this approach is often resource intensive and expensive<sup>1,4</sup>. Computer-based tutors (CBTs) provide a cost-effective adjunct teaching and simulation tool without risking patient safety<sup>4-6</sup>. There is limited evidence for the efficacy of this type of instruction for health professionals; thus, we tested the learning outcomes of a computer-based tutor on trauma care knowledge. We hypothesized that learners using a CBT would demonstrate larger gains in knowledge and better knowledge retention than those randomized to textbook learning.

## **Methods**

This study used an experimental pretest, posttest design. Participants were randomly assigned to either the computer-based tutor on trauma nursing or a control condition (textbook learning). The control condition used sections from the *Trauma Nursing Core Course 7<sup>th</sup> ed.*<sup>7</sup> that addressed concepts taught in the tutor. Both groups completed the same pretest knowledge assessment on trauma nursing. Correct answers were not revealed. After completing the pretest, participants completed the learning activities at their own pace. Participants kept a log of time spent and number of tutor pages completed or textbook pages read. Upon completing the learning sessions, participants took the same test on trauma nursing as at pretest to assess knowledge gain. Participants also retook the test 1 month after the posttest. The knowledge test consisted of 50 items on key aspects of the primary and secondary trauma survey and was reviewed by two certified trauma nurses for content validity.

## **Results**

35 4th year RN students (mean age 21.5, 91% female, 89% white) took the pretest; 34 completed the posttest and 26 completed the 1-month follow-up test. Attrition at 1 month was 16% for the tutor group and 29% for the control group. There was no difference in baseline pretest scores between those randomized to the tutor (M = 26.7, SD = 3.8) and those randomized to the book (M = 28.0, SD = 3.4),  $t(33) = -0.97$ ,  $p = 0.34$ . The hypothesis about learning gains was supported; the tutor had an effect size of 0.98 (using the largest SD). The

tutor group had a significantly higher increase in scores at posttest ( $M = 7.4$ ,  $SD = 3.36$ ) than the control group ( $M = 3.7$ ,  $SD = 3.0$ ),  $t(32) = 3.3$ ,  $p = 0.002$ . The hypothesis about learning retention was not supported. There was no significant difference in score decrease from posttest to 1 month follow-up test between the tutor group ( $M = 0.5$ ,  $SD = 3.41$ ) and control group ( $M = 1.6$ ,  $SD = 2.88$ ),  $t(24) = -0.85$ ,  $p = 0.405$ .

## Conclusions

Use of a computer-based tutor (CBT) led to a larger increase in trauma nursing knowledge than use of a textbook, and the knowledge was retained as well as book-based learning. The effect size of the CBT, 0.98, was relatively high as well—the average for computer tutors is 0.79<sup>8</sup>. These results provide evidence that CBTs can be used as an effective adjunct to prepare for high cost physical simulations. Limitations of this study include a small sample size and use of a single site. Because this study only assessed declarative knowledge, it is unclear how effective the CBT would have been for training relevant perceptual and decision-making skills. One potential extension of this work is to include a low-fidelity simulation within the tutor and to assess the effectiveness of this expanded tutor against traditional methods like high fidelity manikin simulation and hands-on practice on patients.

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This work was supported by the Defense Health Program, W81XWH-15-DMRDP-MSIS-ATUM. For more information, contact "Chris M. Garrison" <cmg35@psu.edu>.