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Effectiveness of Simulation-Based Transthoracic Echocardiography Training on Cardiac Sonography Students' Learning

B. THAMPINATHAN[1], J. WHEATLEY[1], C. REDSELL-MONTGOMERIE[1], L. THOMAS[1], A. KRISHANTHAN[1], A. JOHNSON[1], G. MACLEAN[1], L. RIGGS[1], A. SZABO[2] and J. BURTON[1]

1. Mohawk-McMaster Institute for Applied Health Sciences, Hamilton, Canada
2. McMaster University, Hamilton, Canada

INTRODUCTION

A primary challenge that cardiac sonography students experience during the echocardiography learning process is making the correlation between the anatomical structures of the heart to the transducer created 2-dimensional (2D) ultrasound images. Simulation-based training using a manikin may be an effective tool for learning, however, evidence on the impact of simulation-based training in Transthoracic Echocardiography (TTE) education is limited.

AIM

This study was designed to assess the effectiveness of simulation-based training versus traditional didactic teaching of cardiac anatomy and TTE knowledge on cardiac sonography students.

METHOD

A simulation-based learning lab was developed and implemented into the Fall 2023 Cardiac Anatomy TTE course at the authors' institution.

35 new cardiac sonography students with no former TTE training completed the traditional didactic anatomy course (which included a pre- and post-course knowledge assessment) and participated in the simulation-based learning lab.

Held early in their first semester, the simulation lab consisted of reviewing normal cardiac anatomy using 3-dimensional anatomy software with real-time scanning on the simulation manikin. Students scanned 2D TTE Parasternal Long Axis, Parasternal Short Axis, Apical 4 and Apical 2 chamber views.

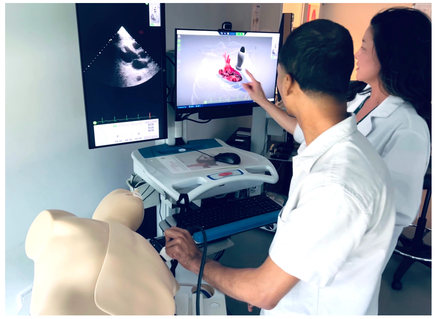

Image 1. Simulation learning lab using ultrasound manikin. Led by instructors, learners scanned TTE views while reviewing cardiac anatomy on interactive 3D cardiac model.

RESULTS

The pre- and post-course knowledge assessment scores from the Fall 2023 simulation cohort (n= 35) was compared to the Spring 2023 control cohort (n= 42) who completed the traditional didactic anatomy course but did not have the simulation learning lab.

The post-course knowledge assessment (Figure. 1) showed higher scores in the simulation cohort with statistical significance ($p<0.0001$). There was an increase in the post-course mean scores between the control and simulation cohort (72.12%, 88.23%), showing a 95% confidence interval (11.76%, 17.65%) increase in grades. The students in the simulation cohort also showed a more unified knowledge (SD, 3.26%) compared to the control cohort (SD, 13.38%). Furthermore, the lowest grade in the simulation cohort was 76.47% compared to 41.18% in the control cohort.

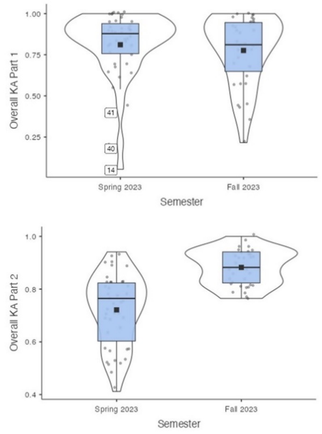

Figure 1. Comparison of pre-course (part 1) and post-course (part 2) knowledge assessment (KA) scores between control cohort (Spring 2023) and simulation cohort (Fall 2023) using the Mann-Whitney U Test.

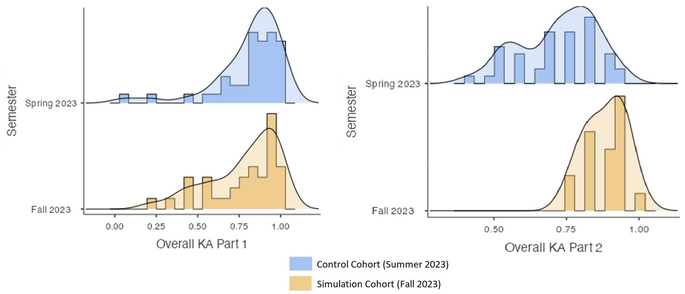

Figure 2. Student score distribution of pre-course (part 1) and post-course (part 2) knowledge assessment (KA) between control cohort (Spring 2023) and simulation cohort (Fall 2023).

CONCLUSIONS

The data from our study suggests that integrating simulation-based teaching into the cardiac sonography educational curriculum correlates to improved knowledge of cardiac anatomy and TTE.

Simulation-based learning can foster a deeper understanding of anatomical structures and imaging techniques, therefore improving student performance.

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CONTACT INFORMATION

Babitha Thampinathan | babitha.thampinathan@mohawkcollege.ca
Jacqueline Wheatley | jacqueline.wheatley@mohawkcollege.ca
Jennifer Burton | jennifer.burton4@mohawkcollege.ca

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