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A Low-Cost Method for Simulating a Cricothyrotomy Procedure in a Ghanaian Nurse Anesthesia Program

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Background/Significance: In the developing world, nurses provide the majority of anesthesia care. In Ghana, the Ministry of Health has given special attention to developing a highly skilled and educated nurse anesthesia workforce. In response, Ghanaian institutions of higher learning have begun to develop degree programs within the specialty. As part of a collaboration between a nurse anesthesia program in the United States (US) and a university in Ghana, a specialized degree completion program was developed for practicing nurse anesthetists. The goal of the collaboration was to co-develop a sustainable teaching model for anesthesia education that would increase student confidence in their existing knowledge, as well as develop new skills for delivering anesthesia care to an increasingly complex patient population.

In the developing world, anesthesia related complications result in a death-rate much higher than in countries with more resources. The most common reason cited for anesthesia-related death in developing countries is an inability of the anesthesia provider to secure a patent airway (Sobhy et al., 2016). Procedures such as emergent cricothyrotomy are essential skills for safe anesthesia care. Practical exposure to high acuity airway management procedures and interventions is a critical component of anesthesia curriculum. In the US, simulation has become an integral component of teaching nurse anesthesia students these skills (Muckler, Kampo, & Morgan, 2017). Simulation-based learning offers students an opportunity for hands-on experiences with which to practice clinical techniques, critically think, and refine psychomotor skills (Hayden, Smiley, Alexander, Kardong-Edgreen, & Jeffries, 2014; Hawkins, et al., 2014; INACSL, 2013; Jeffries, 2012; NLN, 2015). Unfortunately, the high cost that is often associated with simulation equipment often limits its utilization in lower resourced settings (Shilkofski & Meaney, 2016).

Purpose: The purpose of this project was to construct and use a low-cost simulated trachea to instruct Ghanaian nurse anesthesia students to perform an emergent cricothyrotomy.

Methods: A total of 15 Ghanaian nurse anesthesia students received didactic instruction from two US and two Ghanaian faculty on the necessity of, and technique for performing an emergent cricothyrotomy. This included formal lectures, assigned readings, and in-person case discussion. Faculty from both institutions were then asked to identify inexpensive and easily obtained resources for the construction of a simulated trachea, with the goal of training students to perform a cricothyrotomy procedure. A low-cost trachea was built using supplies easily obtained in Ghana, including items like the cylindrical inner cardboard tube of toilet tissue and paper towel rolls. The faculty and students followed a six-step process to construct a trachea model for use in a simulation activity. Ghanaian students were then guided by faculty through the process of performing a cricothyrotomy using the trachea models the students had constructed (Muckler, Kampo, & Morgan, 2017). Students reported their satisfaction with the learning experience, along with their perception of self-confidence in the skill taught, by completing the Student Satisfaction and Self-Confidence in Learning Survey (NLN, 2004). The data was analyzed by program faculty.

Results: All students were easily able to construct their own simulated trachea using supplies found in
their own homes. Students then used their self-constructed trachea to complete the simulation activities. The students reported the experience as a positive learning opportunity. All students reported that the teaching methods were helpful and effective (93.3% strongly agree, 6.7% agree), believed that they were provided with a variety of learning materials to promote learning (73.3% strongly agree, 26.7% agree), and the teaching method was suitable to their learning styles (66.7% strongly agree, 33.3% agree). Most students enjoyed the experience (66.7% strongly agree, 26.7% agree) as well as found the materials motivating and helpful (80.0% strongly agree, 13.3% agree). In addition, all students reported increased confidence in mastering content (33.3% strongly agree, 66.7% agree) as well as developing skills for clinical practice (73.3%, strongly agree, 26.7% agree).

**Conclusion:** In settings where resources limit the availability of high fidelity simulation equipment, low cost techniques can be used to offer meaningful and beneficial learning experiences. Even in the case of high acuity, low frequency interventions, such as the emergency cricothyrotomy, students in lower resource settings can benefit from the opportunities associated with simulation. By using low cost, easily obtainable items, faculty in nursing programs can create access to these opportunities that are easily replicated and sustained.

**Title:**
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**Keywords:**
low cost, nurse anesthesia and simulation

**References:**


Abstract Summary:
As part of a collaboration between a nurse anesthesia programs in the US and Ghana, a project was initiated to construct and use a low-cost simulated trachea to instruct Ghanaian nurse anesthesia students to perform an emergent cricothyrotomy. Student reported satisfaction with the experience and confidence around learning the skill.

Content Outline:

1. Introduction
   a. Background and significance
      i. Educational needs of nurse anesthetists in developing countries
      ii. Collaborations to develop educational strategies
   b. Project objectives
      i. Development of low-cost simulation equipment and techniques
      ii. Evaluation of learning activities

2. Methods:
   a. Project participants
   b. Construction of simulated trachea
      i. Collaborative exercises
      ii. Supplies
   c. Simulation
      i. Pre-simulation work
      ii. Simulation
      iii. De-brief
   d. Survey tool and analysis

3. Results:
   a. Simulated trachea
   b. Student satisfaction with learning
   c. Student confidence in learning

4. Conclusion:
   a. Students can learn high acuity skills using low-cost devices made with everyday supplies
   b. Low-cost solutions can create sustainable opportunities for simulation

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