INTRODUCTION
One of the most complex resuscitation scenarios involves the newborn with hydrops fetalis. These infants often require a number of quickly performed high-risk procedures such as needle thoracentesis, abdominal paracentesis, and sometimes pericardiocentesis in addition to the standard neonatal resuscitation procedures of intubation, bag and mask ventilation, chest compressions, and umbilical line placement.

Existing high-fidelity neonatal simulators (such as the Laerdal SimNewB™ and Gaumard® HAL) are not presently designed to permit needle thoracentesis, abdominal paracentesis and pericardiocentesis. Therefore, simulation of a hydrops scenario has been limited by the need to combine high- and low-fidelity models, or by using a high-fidelity simulator and imaginary invasive procedures.

We have developed a simple, reusable, low-cost modification to an existing high-fidelity simulator that allows participants to obtain vital signs from the simulator while simultaneously performing the invasive procedures of needle thoracentesis, abdominal paracentesis and pericardiocentesis.

We have demonstrated a low-cost, effective way to modify a current high-fidelity simulator to support the resuscitation training of a newborn with hydrops fetalis. The large number of potential interventions, associated complications, and resuscitators required makes this scenario particularly valuable. The complexity of the interventions and group decision making makes the exercise of resuscitating a newborn with hydrops an ideal scenario for training neonatal fellows and advanced neonatal resuscitation teams. Existing high-fidelity models can be enhanced with simple modifications such as these to provide higher fidelity and improve learning experiences.

DESCRIPTION
We began with one of our high-fidelity simulators, the Laerdal SimNewB™, and we protected it by covering it with an Ultrasorb sheet, cutting out openings for the neck, both arms, and umbilicus. We put together a tool kit consisting of latex balloons, duct tape, rubber bands, umbilical cord, rulers, scissors, water, and food coloring.

We taped pieces of plastic against the inside of the SimNewB skin to simulate ribs. We also placed a balloon in a strategic location for pericardiocentesis. The simulated ribs allow students to palpate landmarks prior to inserting a needle for both anterior needle thoracentesis and for pericardiocentesis.

We filled four six-inch latex balloons using yellow food coloring. The two chest tube balloons contained at least 60 mls. Two abdominal balloons were filled with 60 to 120 mls. These were secured to the Ultrasorb-covered mannequin with rubber bands and duct tape.

We obtained a disposable replacement chest skin from a Laerdal SimBaby™. We created a small incision along the skins umbilicus, inserted 2-4 inches of umbilical cord, attached a balloon as a reservoir on the inside, and filled the balloon with 4-5 mls of simulated blood.

We secured the SimBaby skin to the SimNewB using latex tubing (used for simulated veins) and tightened the SimBaby skin sufficiently so that lung excursion is still visible when the simulator is breathing. It is important that the SimBaby skin covering the filled balloons fit tightly or it may be difficult to auscultate the heart rate or observe respirations. Our completed model has been field-tested multiple times among pediatric residents, neonatal nurse practitioners, and at a national workshop on high-fidelity simulation. Participants have been enthusiastic about the low frequency, high stakes, high-risk procedural learning opportunities.