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Child-size mannequin: Hands-on training spares real patients

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Rice University bioengineering students have modified a child-size training mannequin to give medical students hands-on pediatric experience so that real patients can be spared further stress and pain.

The students created Ped.IT, short for Pediatric Evaluation Device Intended for Training, as their senior design project at the request of doctors at Texas Children's Hospital (TCH) who have long recognized the need for students to get hands-on experience in pediatrics without having to subject young patients to additional probing and exams.

"I've been trying since 2003 to develop a mannequin, but I didn't have the bioengineering skills," said Amy Middleman, a pediatrician at TCH and associate professor at Baylor College of Medicine (BCM), which funded the project. "For a long time I've wanted to be able to teach medical students physical exam skills without having to use patients who are not feeling well and whose parents really aren't comfortable with medical students coming in to examine them."

Having tried and failed to work with medical device manufacturers, Middleman found her way to Rice's Oshman Engineering Design Kitchen (OEDK) and its director, Maria Oden, a professor in the practice of engineering education.

Oden pitched the idea to student teams at the start of the fall semester. The four students who stepped up -- Kshitij Manchanda, Zachary Henderson, Minsuk Kwak and Michelle Thorson -- succeeded in

modifying a stock medical training mannequin to TCH's specs, with help from their Rice adviser, Renata Ramos, a lecturer in bioengineering.

Ped.IT (which students have dubbed the "MiddleMannequin" in honor of their mentor) began as a hard-shell mannequin donated by a manufacturer, Laerdal. The team replaced the neck and midriff areas of the plastic with simulated skin and added the simulated liver and spleen, that TCH requested. The students went beyond the call of duty by adding simulated lymph nodes, and they left room for more organs to be added by future OEDK teams.

"There are a lot of conditions our mentors at Texas Children's would like to see in a future version of the mannequin, including an enlarged thyroid and tonsils," Henderson said. "They would also like joints that could be popped out of place and put back in."

Computer-controlled actuators in the 4-foot-long mannequin allow medical students to change the organs from normal to enlarged states.

To create the effect, team members spent time at TCH feeling the livers and spleens of patients willing to help. Rice and Texas Children's are in close proximity in Houston's Texas Medical Center.

"We were completely confused about how a liver actually felt," Manchanda said. "Is it as hard as a rock? As soft as a pillow? I didn't know what the middle ground was. So when I felt them, I thought, 'Oh, this feels like Tempur-Pedic.' You could squeeze and it will come back to its shape."

Tempur-Pedic, best known as material for mattresses, was the right stuff for simulating organs. Another material, Dermasol, was used to simulate skin. "I feel like we've set a good groundwork for materials and the way to make a mannequin that is useful for the physical exam," Thorson said.

"We don't have anything like this in pediatrics," said Jennifer Arnold, medical director of the TCH Pediatric Simulation Center and a BCM assistant professor of pediatrics. "In fact, there's nothing quite like this in the adult world, either. I think there are huge possibilities for commercialization."

Arnold is already talking with manufacturers. "Laerdal is interested," she said. "Now we get to take this back to them and say, 'Hey, do you think you would be interested in helping us mass-produce this, so that every medical school -- even, potentially, every nursing school -- could use this to train their students?'

"This is very sophisticated in what it does right now for physical diagnosis, so I'm very excited. I think there's a need."

"We have been just thrilled," Middleman said. "I've been dreaming about this for years, and it's the students who have really brought this to fruition. I could not be happier. I'm so excited that we've started on the way to developing this."

Provided by Rice University