Antibiotic Resistance

Marsolo team researching techniques for early identification

Researchers at Cincinnati Children's Hospital Medical Center are using Ohio Supercomputer Center services as they zoom down to the genomic level to identify patients at risk of developing antibiotic resistance, a serious emerging health threat.

Keith Marsolo and his team are developing novel techniques that could be used to more quickly identify patients whose bodies no longer respond to standard-use antibiotics. Sick children at CCHMC can develop this resistance after the many rounds of different antibiotics they receive to ward off infections from their weakened immune systems.

"Once the patients who become sick develop infections, it becomes harder and harder to treat them because they've developed a resistance to so many types of antibiotics that clinicians just run out of options," said Natalia Connolly, a research associate for the study at CCHMC.

Partnering with David Haslam and Heidi Andersen, colleagues in CCHMC's Division of Infectious Diseases, the team obtained fecal samples from three cohorts: sick pediatric inpatients, healthy outpatient children and healthy adults. With data-processing help from OSC, Marsolo's team used a machine-learning approach known as support vector machines to analyze the samples OSC's resources were crucial in training the SVM, as multiple parameters had to be tested in order to discover the optimal model.

"Because you have so many parameters and each one of them has a multitude of options, you really can't do it without some serious computing power," Connolly said.

With promising results from the initial study, the team is working with Drs. Haslam and Andersen on a larger prospective study. With a limited number of antibiotic drugs on the market, Marsolo's hope is the study will provide early measures for identifying sick patients most prone to developing infections, as the current process is quite slow.

"If you know ahead of time that they've got the multi-drug resistance, you can go for the more powerful antibiotics in the beginning and potentially treat them with more targeted therapy or isolate them sooner so that you can limit the spread of the infection," Marsolo said.

As far as a long-term "wish list," clinicians could possibly restore a normal intestinal environment in patients with an off-balance microbiome through targeted probiotics or even microbiome transplants.

"This is still very new and very novel, but that's where I hope that this work will go," Connolly said. •

Antibiotic resistance is a serious emerging health threat, especially to children with chronic medical conditions.