

New blood draw protocol could minimize risk for critically ill children

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Johns Hopkins clinicians care for a child in the pediatric ICU. Researchers have created a new protocol that can reduce risks associated with taking unnecessary blood cultures from pediatric patients. Credit: Johns Hopkins Medicine

Johns Hopkins researchers report that implementing a checklist-style set

of procedures appears to cut almost in half the number of potentially unnecessary blood culture draws in critically ill children without endangering doctors' ability to diagnose and treat life-threatening blood infections.

In a description of their two-year-long project, published in *JAMA Pediatrics*, the investigators say that safely reducing the frequency of blood draws in hospitalized children with fevers has historically not been a hospital priority despite the stress, pain and high rate of false positives associated with the procedure.

The researchers found that fostering cross-departmental collaboration and offering guidelines to clinicians helped reduce the number of unnecessary blood draws on some of the smallest and most vulnerable patients at the Johns Hopkins Children's Center. Clinicians were able to accomplish an immediate reduction in unnecessary blood draws using the newly designed checklist protocols, and they were able to sustain the reduction over time.

"Our work focuses on the prevention of infections, in this case blood infections, in hospitalized patients," says Aaron Milstone, M.D., associate professor of pediatrics at the Johns Hopkins University School of Medicine and associate hospital epidemiologist at The Johns Hopkins Hospital. "We have found that blood cultures are a really challenging test to go after because the perceived risks are pretty low, which leads to overuse." There are currently no existing guidelines that help clinicians decide if a blood culture is needed, but the researchers say the common protocol is to order a blood draw whenever a fever is present because fever can indicate sepsis. This practice can lead to unnecessary blood draws.

In addition to the stress and pain associated with this procedure in young patients, the risk from blood cultures comes from the unintended

consequences of false-positive results. Treating these pseudo-infections leads to longer hospital stays, which can lead to more hospital-borne infections and an increased risk of antibiotic-resistant diseases due to the overuse of antibiotics. "It is common for children in the ICU to have a fever and get a blood culture. Sometimes, the culture is positive, but before the clinician can order treatment, the child clears the fever on his or her own," says Charlotte Woods-Hill, M.D., attending physician in the Division of Critical Care Medicine at the Children's Hospital of Philadelphia. "The clinicians are left with the decision of what to do with that information, so to be safe, they to treat them. We have had a number of kids who are ready to go home and the next thing you know, they are spending two more weeks in the hospital getting IV antibiotics because a blood culture was positive."

The team's concern grew from the high rate of false-positive results. In general, only 5 to 15 percent of blood cultures drawn because of fevers test positive, and as many as 50 percent of those positive results can be false positives. Despite the inaccuracies of this type of screen, many doctors still order blood cultures for most patients presenting a fever because of the fear surrounding the risk of sepsis. However, sepsis is only one among a long list of conditions that can cause a fever. For example, withdrawal from narcotics, adverse reactions to medications or being too physically hot for too long can all cause a fever, necessitating the use of precision medicine to evaluate the risk of sepsis individually for each patient. These factors combined made blood cultures a natural target for the team in their efforts to implement high-value care in the Johns Hopkins pediatric ICU.

Drawing on clinical experience and data, a collaborative team of nurses, vascular access specialists and physicians across specialties developed a checklist-style protocol. The checklist and an accompanying decision-making flow chart were created to guide caregivers before deciding to draw blood. Factors such as unexplained tachycardia, fever and immune

deficiency are conditions that may warrant a blood culture, while caregivers were advised that drug withdrawal and recent negative blood cultures with no clinical change may not warrant drawing blood.

These tools were subsequently posted in the pediatric ICU at The Johns Hopkins Hospital with instructions to be completed at the bedside by nurses and physicians. Each week, the team would meet to evaluate the data gathered, review how many cultures were sent from the unit and discuss in detail individual cases where blood draws were necessary.

The researchers compared patient length of stay, mortality, readmission and the number of episodes of suspected septic shock at the hospital before and after intervention. In the year before the team introduced the tools, there were 2,204 patient visits to the pediatric ICU and 1,807 blood cultures drawn. After intervention, that number was decreased to 984 blood cultures drawn for 2,356 patient visits, almost halving the number of blood cultures per patient day.

Comparing the pre- and post-intervention periods, there was no statistical difference in the occurrence of septic shock, hospital mortality or hospital readmission, which, according to Milstone, means that patients experienced no increased risk of a missed sepsis diagnosis because of the intervention.

"I really believe that this constant feedback and discussion about why action was taken was key in driving change," says Milstone. By assessing other potential causes of each patient's fever using the tools, clinicians were able to appropriately treat patients based on their individual risk.

The checklist approach also showed the potential to be used in improving the use of antibiotics in hospitals. Misuse and overuse of antibiotics is a prevalent problem in the medical community, leading to increased rates of microbial resistance and the spread of multidrug-

resistant organisms. "People often immediately link infection with antibiotics, but using the checklists seemed to help physicians critically analyze whether or not the patient was really infected, reassuring them in some cases that there was no need for antibiotic treatment," says Milstone.

"While our study was promising, there are limitations," says James Fackler, M.D., associate professor of anesthesiology and [critical care medicine](#) at the Johns Hopkins University School of Medicine.

"Primarily, clinicians are uneasy when asked to do less, especially when facing an acute condition like sepsis. We hope that the tools developed by our team will ease these concerns by offering guidelines for a clear and effective path to diagnosis." The future directions of this study include further exploring the implications this process may have for antibiotic use as well as working to implement these tools in other ICUs. The tools are already being tried at Johns Hopkins All Children's Hospital in Florida and in the pediatric ICU at the University of Virginia.

Provided by Johns Hopkins University School of Medicine

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