

Risk calculator helps personalize care for heart failure patients

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A left ventricular assist device (LVAD) heart pump. Pump placement is often lifesaving but can introduce serious risks. Credit: Charlie Ehlert/ University of Utah Health

Late-stage failure of the left side of the heart is an often-fatal condition

affecting hundreds of thousands of people in the U.S. alone. A mechanical heart pump can be a lifesaving intervention for such patients, but the surgery to implant the pump can be risky.

One of the most serious risks is right [heart](#) failure, in which the right side of the heart becomes unable to pump enough blood to the lungs. Identifying patients who have a high risk of right heart failure can help doctors better prepare patients for heart pump placement. But predicting who is most at risk has proven difficult.

A nationwide team led by researchers at University of Utah Health has now developed a way to predict a patient's individualized risk of right heart failure following surgery to place the pump. The team is now using this [risk calculator](#) to tailor care to each patient before and during heart pump placement. Their results are published in *JAMA Cardiology*.

Finding the needle in the data haystack

For people who undergo surgery to implant a left heart pump, the risk of subsequent right heart failure is high: 15% to 30%. But the large number of factors that contribute to an individual's risk of right heart failure make personalized risk prediction "exceptionally difficult," says Iosif Taleb, M.D., currently a cardiology fellow at University of California, San Diego and first author on the study. Taleb helped develop the risk calculator during his clinical research fellowship at U of U Health.

"Each patient is unique with different health conditions and heart characteristics," Taleb says. "Heart pumps also have specific traits, and the combination of these factors makes predictions tough."

Stavros Drakos, M.D., Ph.D., professor of cardiology at U of U Health and senior author on the publication describing the study, says that "there have been efforts in the past to predict which patients will get a heart

pump [also called a left ventricular assist device, or LVAD] and will not do well, but they didn't perform well in the real world." Even models that seemed to predict outcomes in one hospital often failed to give accurate predictions at another.

Aiming to develop a more accurate and broadly usable risk calculator, the researchers used patient data from 1,125 people across six [health centers](#), including U of U Health. Taking into account variables ranging from pre-existing health conditions to medications and demographic information, they used machine learning to generate and test many models of risk and find the one that best described patients' health outcomes.

Their model identified several variables that are especially useful when predicting whether a patient will develop right heart failure (RVF), such as whether patients needed additional forms of heart support before their initial surgery in order to better prepare them and lead to better outcomes. The researchers used these factors to develop [an easy-to-use online calculator](#) that determines a patient's percentage risk of right heart failure after surgery.

The new risk calculator, called STOP-RVF, describes individual risk more accurately than earlier models. Importantly, it also works well in a variety of situations.

After creating the risk calculator, the researchers "checked their work" by using it to calculate risks retrospectively for patients in another hospital system. The scientists then compared the calculator's predictions to the patients' real-world outcomes, finding that their tool was still able to accurately model patients' risk of subsequently developing right heart failure.

Predicting outcomes nationwide

Building the model on data from a large and diverse population was essential to accurately describe risk for patients nationwide. "It's important because we live in a very diverse country," Drakos says.

"By basing this analysis in multiple sites all over the country—the Washington, DC, area, the Detroit area, California, Utah, and the broader Mountain West area—it's representative of a large part of our country. It strengthens the generalizability of the work."

The cardiologists, surgeons, and nurse coordinators of the heart failure and LVAD team at U of U Health have already started using the calculator in their own clinical practice to personalize care.

"It helps tailor the risk assessment for each patient, allowing for better preparation before surgery," Taleb explains. For patients who have a high risk of right heart failure, doctors can delay the surgery, use different medications to improve patients' odds of recovery, or consider alternative treatments.

Since the calculator has only been in use in the clinic for a short time, it's too early to say if it will improve patient outcomes. But Drakos expects that it will be more useful than previous models because it was developed using patient populations from multiple hospitals.

"We validated it in other hospitals, and it performed very well," he says. "But of course, time will tell how significant its impact on patient outcomes will be."

More information: Machine Learning Multicenter Risk Model to Predict Right Ventricular Failure After Mechanical Circulatory Support, *JAMA Cardiology* (2024). [DOI: 10.1001/jamacardio.2023.5372](https://doi.org/10.1001/jamacardio.2023.5372)

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