

Predicting risk of heart failure for diabetes patients with help from machine learning

September 13 2019

Heart failure is an important potential complication of type 2 diabetes that occurs frequently and can lead to death or disability. Earlier this month, late-breaking trial results revealed that a new class of medications known as SGLT2 inhibitors may be helpful for patients with heart failure. These therapies may also be used in patients with diabetes to prevent heart failure from occurring in the first place. However, a way of accurately identifying which diabetes patients are most at risk for heart failure remains elusive. A new study led by investigators from Brigham and Women's Hospital and UT Southwestern Medical Center unveils a new, machine-learning derived model that can predict, with a high degree of accuracy, future heart failure among patients with diabetes. The team's findings are presented at the Heart Failure Society of America Annual Scientific Meeting in Philadelphia and simultaneously published in *Diabetes Care*.

"We hope that this risk score can be useful to clinicians on the ground—[primary care physicians](#), endocrinologists, nephrologists, and cardiologists—who are caring for patients with diabetes and thinking about what strategies can be used to help them," said co-first author Muthiah Vaduganathan, MD, MPH, a cardiologist at the Brigham.

"Our risk score provides a novel prediction tool to identify patients who face a heart failure risk in the next five years," said co-first author Matthew Segar, MD, MS, a resident physician at UT Southwestern. "By not requiring specific clinical cardiovascular biomarkers or advanced imaging, this risk score is readily integrable into bedside practice or

electronic health record systems and may identify patients who would benefit from therapeutic interventions."

To develop the risk score—called WATCH-DM—the team leveraged data from 8,756 patients with diabetes enrolled in the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial. These data included a total of 147 variables, including demographics, clinical information, laboratory data and more. The investigators used machine-learning methods capable of handling multidimensional data to determine the top-performing predictors of heart failure.

Over the course of almost five years, 319 patients (3.6 percent) developed heart failure. The team identified the 10 top-performing predictors of heart failure, which make up the WATCH-DM risk score: weight (BMI), age, hypertension, creatinine, HDL-C, diabetes control (fasting plasma glucose), QRS duration, myocardial infarction and coronary artery bypass grafting. Patients with the highest WATCH-DM scores faced a five-year risk of heart failure approaching 20 percent.

The study draws strength from its large sample size and the high rate of heart failure, but the authors note that their findings may be constrained by certain limitations. ACCORD was conducted between 1999 and 2009, and predictors of heart failure may have evolved since the trial's conclusion. In addition, while the risk score was accurate in predicting one form of heart failure—that with reduced ejection fraction—it fell short for predicting a second form of heart failure—that with preserved ejection fraction. Future studies will be needed to develop specific risk scores for predicting the latter among the general population and among patients with diabetes.

Importantly, the WATCH-DM risk score is now available as an online tool for clinicians to use. As a next step, the research team is working to integrate the [risk score](#) into electronic health record systems at both the

Brigham and UT Southwestern to facilitate its practical use.

In addition to the tool's usefulness for clinicians, Vaduganathan also sees a key message from the study for patients with diabetes who are concerned about their risk of heart failure.

"It's important to look at these 10 variables and reflect on them," said Vaduganathan. "For individual patients, these are important messages to think about when assessing personal risk. BMI was one of the top predictors of heart failure risk, which reinforces the idea that long-term excess weight may increase future risk for heart failure. We hope this work highlights ways to intervene—both through lifestyle changes and through the use of SGLT2 inhibitors—to delay or even entirely prevent heart failure."

"This risk tool is an important step in the right direction to promote prevention of [heart](#) failure in patients with type 2 diabetes. It can be readily used as part of clinical care of patients with type 2 [diabetes](#) and integrated with the electronic medical records to inform physicians about the risk of [heart failure](#) in their patients and guide use of effective preventive strategies," said Ambarish Pandey, MD, MSCS, a preventive cardiologist at UT Southwestern and the senior author of this study.

More information: Segar, M, Vaduganathan M et al. "Machine Learning to Predict the Risk of Incident Heart Failure Hospitalization Among Patients With Diabetes: The WATCH-DM Risk Score" *Diabetes Care* [DOI: 10.2337/dc19-0587](https://doi.org/10.2337/dc19-0587)

Provided by Brigham and Women's Hospital

Citation: Predicting risk of heart failure for diabetes patients with help from machine learning

(2019, September 13) retrieved 3 May 2024 from <https://medicalxpress.com/news/2019-09-heart-failure-diabetes-patients-machine.html>

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