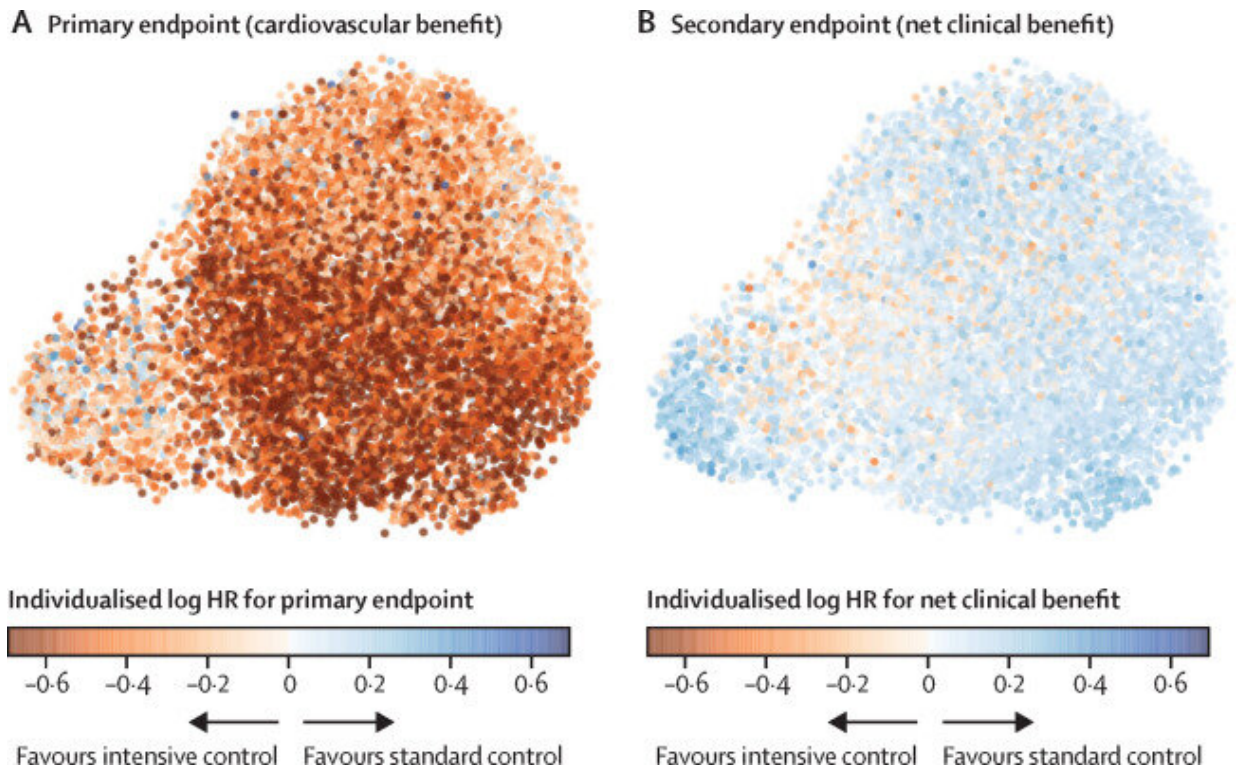
A machine learning–guided approach for blood pressure management

October 27 2022, by Elisabeth Reitman



Cardiovascular benefit phenomaps of intensive blood pressure reduction in SPRINT phenomap representation of the individualized HRs with intensive versus standard blood pressure control for the primary (A) and secondary (B) outcomes HR=hazard ratio. SPRINT=Systolic Blood Pressure Intervention Trial. Credit: *The Lancet Digital Health* (2022). DOI: 10.1016/S2589-7500(22)00170-4

Hypertension, a sustained blood pressure greater than 140/90 mm Hg, is

among the leading causes of heart disease, disability, and premature mortality globally. The level to which blood pressure should be lowered to ameliorate this risk, however, has been debated, especially for patients with Type 2 diabetes for whom the evidence of aggressive blood pressure control has been inconclusive in clinical studies.

Researchers at Yale have developed a machine learning-based tool to personalize the consideration for pursuing intensive versus standard blood pressure treatment goals among individuals with and without diabetes. The novel clinical decision support tool supports shared decision making between patients and providers through a data-driven approach.

The tool is described in a study published Oct. 25 in *The Lancet Digital Health*.

For the study, first author Dr. Evangelos K. Oikonomou, and senior author Dr. Rohan Khera, assistant professor at the Yale School of Medicine and director of the Cardiovascular Data Science (CarDS) Lab, collected data from two randomized clinical trials: SPRINT (Systolic Blood Pressure Intervention Trial), and ACCORD BP (Action to Control Cardiovascular Risk in Diabetes Blood Pressure).

In both scenarios, patients were randomized to an intensive or routine systolic blood pressure goal of 120 mm Hg or 140 mm Hg. Using participant-level data from SPRINT, a study that did not include patients with diabetes but demonstrated the value of achieving lower blood pressures, the investigators identified 59 distinct variables including kidney function, smoking, and statin or aspirin use to develop the machine learning algorithm that identified features of patients that benefitted most from intensively lowering blood pressure. Next, the research team assessed the value of this algorithm within the distinct ACCORD BP trial—a trial of patients with diabetes where intensive

blood pressure treatment was not found to be effective.

The team found that the algorithm, called PRECISION (PREssure Control In hypertenSION), was able to define patients with diabetes who benefitted from aggressive blood pressure management, compared with standard treatment. PRECISION provides practical, reliable information based on the effect of intensive compared with standard systolic blood pressure treatment among patients with diabetes, the researchers say.

"Identifying the appropriate blood pressure targets and treatment course for patients with hypertension and diabetes can be challenging," said Khera. "Here, we used machine learning to enhance inference from two landmark clinical trials in assessing a personalized cardiovascular benefit of intensive blood pressure control. The key finding is that the benefit profile derived in patients without diabetes seems to define those with diabetes that benefit from such a treatment strategy."

Khera added: "We also pursue a series of data experiments to demonstrate the value of our phenomapping approach in defining embedded treatment response signatures in randomized clinical trials. Such an approach has potential value in learning more about the effects of treatments on individual patients.

"Moreover, it represents a novel way to enrich clinical trials based on phenotypic response profiles defined from existing data."

The authors noted that further testing in diverse patient populations is needed to better understand how biological, clinical, and socioeconomic factors contribute to the risks and benefits of an intensive blood pressure lowering strategy.

More information: Evangelos K Oikonomou et al, Individualising intensive systolic blood pressure reduction in hypertension using

computational trial phenomaps and machine learning: a post-hoc analysis of randomised clinical trials, *The Lancet Digital Health* (2022). DOI: 10.1016/S2589-7500(22)00170-4