

Enhancing treatment for persistent hypertension through electronic records

March 9 2023, by Elisabeth Reitman



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In the United States, managing hypertension or high blood pressure has proven to be challenging. Despite the availability of antihypertensive medications and the benefits of regular exercise, a significant number of

patients continue to struggle with persistent hypertension. To tackle this issue, a new taxonomy is being developed that seeks to target the root causes of this condition.

Led by Yuan Lu, ScD, an assistant professor at the Yale School of Medicine and a member of Yale's Center for Outcomes Research & Evaluation (CORE), the study was published Feb. 2 in the journal *Circulation: Cardiovascular Quality and Outcomes*.

Physicians may prescribe one or more antihypertensive treatments to help patients achieve a target blood pressure below 130 mmHg and 80 mmHg. However, patients with treatment-resistant [hypertension](#) have an underlying condition that makes the medication less effective. The term persistent hypertension is a more encompassing concept than resistance hypertension, which refers to multiple blood pressure elevation over time.

Patients with persistent hypertension may include people with resistant hypertension, absence of a diagnosis, inadequate treatment or lifestyle modification, poor adherence, missed appointments, and those with other barriers to [health care](#). In this study, Lu and colleagues analyzed patients at Yale New Haven Health System with 5 or more consecutive elevated blood pressure measurements between January 1, 2013–October 31, 2018. They conducted a qualitatively content analysis of clinician notes in the electronic health records (EHRs).

"In our data from the Yale New Haven Health System we found that treatment-resistant hypertension is 5%–10% of all the patients with hypertension. Many patients have persistent hypertension due to other reasons such as financial barriers and poor adherence to medications," said Lu.

Phase two [clinical trials](#) for a treatment-resistant hypertension drug are

expected to begin later this year. However, a new drug will not tackle the source of the problem. "Given the many reasons why patients may have persistent hypertension, the interventions to address these reasons are different," said Lu. "First, we need to classify people and determine what are the barriers to achieve blood pressure control and then match them to targeted interventions that address these barriers."

"For example, some patients may benefit from having a social worker if they have financial issues with obtaining medications. For others, intensifying antihypertensive treatment may be needed if the current medication is not enough. We are currently leveraging a taxonomy through Yale New Haven Health System, but we believe this pipeline could be applied to other [health systems](#) and to other chronic conditions such as diabetes," she said. The goal is to use computer algorithms to automate this taxonomy and enhance personalized interventions for patients with persistent hypertension.

The power of data science to advance hypertension care

Data science and implementation science research can be used to enhance personalized care for hypertension. The next step of this study would be to develop a system that can automate the taxonomy using [machine learning](#) and natural language processing methods and design EHR-based clinical decision support tools that could connect patients to targeted, high-quality care at scale. Such tools could send automated notifications to the primary care team, recommend the appropriate therapy, or connect the patient with services to improve their overall health.

"One idea that we have is called a command center to monitor the patients and match them to clinical decision support tools, and face-to-face session if needed. How we do design an intervention that can fit into the physician's workflow, and the physicians are willing to use it? It

will be a combination of [data science](#) and implementation science to guide the precision intervention for these patients," said Harlan Krumholz, MD, SM, the senior author of this paper and director of the Center for Outcomes Research and Evaluation.

The team hope to pilot this idea at Yale New Haven Health System in the future. Their current focus is improving hypertension control for 40,000 hospital employees and their dependents. "It's a very diverse population in terms of age, sex, and racial ethnicity. We are working with the leadership from the Heart and Vascular Center at Yale New Haven Health to develop computer algorithms to better stratify patients by their barriers to care," said Lu.

A patient will likely see different providers over time, which can result in a missed treatment opportunity and add to the clinician burden. "The patient may not see the same provider during their trajectory. Key things can get buried in unstructured clinical notes, so it's easy to miss or get lost. During the 15 to 20-minute clinical encounter, the algorithm would go through all these notes and figure out what might be the root cause after talking to the patient," she added.

"We also provide a possible action to address each of these issues," added Lu. Regarding non-intensification of treatment, the data suggests that the most common issue was provider purview. This means that patients were seen by multiple specialty physicians for different chief concerns, including concerns unrelated to hypertension. The office visits where elevated blood pressure was measured were with specialists who often do not treat hypertension. For example, these visits were frequently with orthopedic, podiatry, or radiation oncology providers who do not routinely manage hypertension. A possible solution could be to send an EHR notification to the primary care provider's office to automatically schedule an appointment.

Data science and implementation science research can be used to optimize hypertensive care. The goal of this study is to develop a system that can automate the taxonomy and connect patients to targeted, high-quality care at scale.

More information: Yuan Lu et al, Developing an Actionable Taxonomy of Persistent Hypertension Using Electronic Health Records, *Circulation: Cardiovascular Quality and Outcomes* (2023). [DOI: 10.1161/CIRCOUTCOMES.122.009453](https://doi.org/10.1161/CIRCOUTCOMES.122.009453)

Provided by Yale University

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