Socioeconomic status measure helps researchers develop artificial intelligence models, improving equity in health care

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Social determinants of health impact people's well-being and quality of life. These social determinants—conditions such as access to nutrition,

safe and affordable housing, jobs, transportation, and access to health care—are some of the factors that lead to disparities in health and health care if they are not addressed.

"Defining and assessing social determinants of health really invites clinicians, educators, and researchers to embrace a broader understanding of health in the social context, beyond perhaps narrowly defined or focused biomedical factors," explains Dr. Young Juhn, a Professor of Pediatrics at Mayo Clinic, director of the artificial intelligence (AI) program for the Department of Pediatrics, and Research Chair of Mayo Clinic Health System. "So, it's really defined as situations or conditions that are taking place in daily living, impacting a broader range of health outcomes, functioning, and quality of life."

Health care organizations, including Mayo Clinic, are working to improve health equity and health outcomes while reducing health care costs. One of the problems facing health care organizations is the lack of reliable and accurate individual-level socioeconomic status (SES) data which is a key element of social determinants of health because SES is defined as one's ability to access desired resources such as health care, education, occupation, housing and neighborhood resources.

"It is a major challenge to properly measure and apply individual-level SES data to health care delivery and research because such measures with reliability, accuracy, and scalability are not available," says Dr. Juhn.

Dr. Juhn and his team are trying to tackle this roadblock by focusing their research on providing a validated, objective, and scalable individual-level SES measure using publicly available property data. Developed in Dr. Juhn's Precision Population Science Lab, the Housing-Based Socioeconomic Status (HOUSES) Index is a cloud-based software tool that allows researchers to measure individual-level SES based on an

address and publicly available housing assessment data. With support from an NIH grant, the research has been expanded to 44 U.S. states with plans to complete its expansion to the entire U.S.

How can this data help improve health equity?

Dr. Juhn explains that the HOUSES Index can help [health care organizations](link) anticipate and identify those in need of social determinants of health support services such as transportation, [social support](link), or [financial help](link), before or after costly services like transplantation or cancer treatment. It also can help monitor how [social determinants](link) of health change over time, which enables early identification of support needs.

"To demonstrate the analytic capability of HOUSES, we conducted geospatial analysis to identify hot spots of COVID-19 cases during the early phase of the pandemic, " explains Dr. Juhn. "We found hot spots in areas with highly concentrated residents such as low-income apartments and mobile home communities. We then guided the practice to reach out to these underserved populations for COVID and influenza vaccinations. They can actually reach out to people in a very targeted area through community engagement."

Dr. Juhn and his lab are partnering with Mayo Clinic Platform to identify and detect AI bias by using the HOUSES Index. One example came to light when studying asthma. The research showed a significant difference in the machine learning model performance, meaning AI bias, between asthmatic children with low and higher SES as measured by HOUSES.

"As scientists, we are very good at doing discovery science and translational science, but not necessarily implementation and dissemination science. The Mayo Clinic Platform can play an important

role in how can we really make this a useful tool and technology available to users and earn trust for the application of AI tools to [health care](link)."

"We looked at where the bias was coming from," explains Dr. Juhn. "We found children coming from lower socioeconomic backgrounds had much more prevalence of missing data, meaning data incompleteness. And a second problem was inaccuracy—meaning, there is a group of children who met the asthma criteria but did not have an asthma diagnosis. These biases may keep them from accessing preventive and therapeutic interventions. These observations raise a concern about the difference in the quality of electronic health records among patients with different SES backgrounds, which may underlie potential AI model bias by SES."

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