AI model using daily step counts predicts unplanned hospitalizations during cancer therapy

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An artificial intelligence (AI) model developed by researchers can predict the likelihood that a patient may have an unplanned

hospitalization during their radiation treatments for cancer. The machine-learning model uses daily step counts as a proxy to monitor patients' health as they go through cancer therapy, offering clinicians a real-time method to provide personalized care. Findings will be presented today at the American Society for Radiation Oncology (ASTRO) Annual Meeting.

An estimated 10–20% of patients who receive outpatient radiation or chemoradiation therapy will need acute care in the form of an emergency department (ED) visit or hospital admission during their cancer treatment. These unplanned hospitalizations can be a major challenge for people undergoing cancer treatment, causing treatment interruptions and stress that may impact clinical outcomes. Early identification and intervention for patients at higher risk of complications can prevent these events.

"If you can anticipate a patient's risk of unplanned hospitalization, you can change how you support them through their cancer treatments and reduce the likelihood that they will end up in the ED or hospital," said Julian Hong, MD, senior author of the study and an assistant professor of radiation oncology and computational health sciences at the University of California, San Francisco (UCSF), where he also serves as Medical Director of Radiation Oncology Informatics.

Dr. Hong's team previously demonstrated that a machine learning algorithm using health data such as cancer history and treatment plan could identify patients at higher risk of ED visits during cancer treatment, and that additional surveillance from their providers reduced acute care rates for these patients.

For the current study, he and Isabel Friesner, lead author and a clinical data scientist at UCSF, collaborated with Nitin Ohri, MD, and colleagues at Montefiore Medical Center in New York to apply machine learning

approaches to data from wearable consumer devices. Dr. Ohri and his team previously collected data from 214 patients in three prospective clinical trials (NCT02649569, NCT03102229, NCT03115398).

In each of these trials, participants wore fitness trackers that monitored their activity over several weeks while they received chemoradiation therapy. Trial participants had different types of primary cancers, most commonly head and neck (30%) or lung (29%) cancer.

Step counts and other data from these patients' records were used to develop and test an elastic net-regularized logistic regression model, a type of machine-learning model that can analyze a large amount of complex information. The goal of their model was to predict the likelihood that a patient would be hospitalized in the next week, based on their previous two weeks of data.

Researchers first created the model by examining how well different variables predicted hospitalization, using data from 70% of the trial participants (151 people). Potential predictors in the model included patient characteristics (e.g., age, ECOG performance status), as well as activity data measured before and during treatment. In addition to daily step totals, the researchers computed other metrics, such as relative changes to a person's week-by-week averages or the difference in the minimum and maximum number of steps each week.

The research team then validated the model using the remaining 30% of patients (63 people). The model that integrated step counts was strongly predictive of hospitalization the following week (AUC = 0.80, 95% confidence interval [CI] 0.60-0.90), and it significantly outperformed the model without step counts (AUC = 0.46, 95% CI 0.24-0.66, p

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