AI predicts patients at highest risk for severe pain, increased opioid use post-surgery

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Artificial intelligence (AI) used in machine learning models can predict which patients are at highest risk for severe pain after surgery, and help determine who would most benefit from personalized pain management plans that use non-opioid alternatives, suggests new research being presented at the ANESTHESIOLOGY 2020 annual meeting.

Some patients experience more [severe pain](#) after [surgery](#) and need higher doses of opioids for longer periods of time, which increases their risk for [opioid](#) abuse disorder. By knowing which patients are at higher risk for severe post-surgical [pain](#), physician anesthesiologists can create an anesthesia plan using non-opioid alternatives—such as nerve blocks, epidurals and other medications—to more effectively address pain and reduce the need for opioids.

Currently physicians use time-consuming questionnaires to identify patients at higher risk for severe post-surgical pain, asking about their history of anxiety, sleep quality and depression. In this study, researchers sought a faster, more effective method using machine learning, where a system learns and evolves based on data it is provided. They created three machine learning models that analyzed patients' electronic medical records, which identified that younger age, higher body mass index, female gender, pre-existing pain and prior opioid use were the most predictive factors of post-surgical pain.

"We plan to integrate the models with our [electronic medical records](#) to provide a prediction of post-surgical pain for each patient," said Mieke A. Soens, M.D., lead author of the study and an anesthesiologist at Brigham and Women's Hospital and anesthesiology instructor at Harvard Medical School, Boston. "If the patient is determined to be

at high risk for severe post-surgical pain, the physician anesthesiologist can then adjust the patient's anesthesia plan to maximize non-opioid pain management strategies that would reduce the need for opioids after surgery."

In the two-part study, researchers looked at data from 5,944 patients who had a wide variety of surgeries, including gallbladder removal, hysterectomy, hip replacement and prostate surgery. Of those, 1,287 (22%) had consumed 90 morphine milligram equivalent (MME) in the first 24 hours after surgery, which is considered a high dose. In the first part of the study, they used 163 potential factors to predict high pain post-surgery, based on a literature search and consultation with experts. From there they created three machine learning algorithm models (logistical regression, random forest and [artificial neural networks](#)) that mined the patients' medical records and whittled the 163 predictor factors down to those which most accurately predicted patients' pain severity and potential opioid needs after surgery.

In the second part, they compared what the models predicted to actual opioid use in those same patients. They determined all three models had similar predictive accuracy overall: 81% for logistical regression and random forest methods and 80% for artificial neural networks. That means the models accurately identified which people were more likely to have severe pain and need higher doses of opioids about 80% of the time.

"Electronic medical records are a valuable and underused source of patient data and can be employed effectively to enhance patients' lives," said Dr. Soens. "Selectively identifying [patients](#) who typically need high doses of opioids after surgery is important to help reduce opioid misuse."

Provided by American Society of
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