# Researchers explore potential for AI to predict patients' pain management support needs after surgery

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A Mayo Clinic retrospective study of 9,731 patients explored the

potential of artificial intelligence (AI) to predict a patient's need for opioid refills after surgery. The study used deep learning models, a form of AI, to predict which patients are most likely to require additional opioid refills after surgery while ensuring adequate pain management and minimizing the risk of opioid dependence. Refills were defined as any opioid prescribed from one to 30 days after hospital discharge.

Researchers looked at a wide range of surgeries, including 280 thoracic, 1,680 abdominal, 1,575 pelvic and 5,952 musculoskeletal or orthopedic procedures. The study also examined 507 breast surgeries, 1,243 head and neck procedures and 133 vascular surgeries. Notably, 2,086 of the surgeries involved minimally invasive techniques.

With the assistance of AI, the findings revealed that the type of surgery, a patient's reported pain level during hospitalization and the initial number of opioids prescribed were the key predictors of needing refills. Knee replacement surgery emerged as the most significant predictor.

Researchers emphasize that identifying patients who may need prescription refills does not mean simply prescribing more opioids. Rather, through the AI models, health care professionals can work with patients to consider non-opioid pain control strategies.

"Numerous opioid-based medications, non-opioid-based medications and non-pharmacologic strategies exist to manage postoperative pain," says senior study author Cornelius A. Thiels, D.O., a surgical oncologist at Mayo Clinic. "This predictive model is intended to help physicians identify when the current strategy is insufficient and augment that strategy with these tools as needed."

Overall, the researchers agree that a personalized approach to pain management can help minimize reliance on opioids. They underscore that the key to success is using these AI models as supportive health care

tools, with clinicians working in tandem with AI, rather than using it as a replacement for decision-making.

"These systems work as an assistant to health care professionals, and the final decision is ultimately by them based on the overall opinion about the patient," says lead study author Hojjat Salehinejad, Ph.D., a health care systems engineering researcher at the Mayo Clinic Robert D. and Patricia E. Kern Center for the Science of Health Care Delivery. Dr. Salehinejad also focuses on applied AI in health care, particularly multimodal patient representation and learning.

While the mathematical modeling used in the study is more advanced, the overall concept is something physicians have relied on for years, the researchers say. Although further validation is needed before implementing this into practice, they note that clinicians must use AI as a supportive tool to improve patient treatments rather than as a substitute for judgment.

"The goal has never been to replace physician discretion and decision-making but rather to provide evidence-based data and analytics to help with the [decision-making](link)," says Dr. Thiels. "The primary advantage here is the models' ability to use larger quantities of data automatically, without relying on manual input from physicians, which is how predictive models have traditionally been built."

Dr. Thiels is an alumnus of the Surgical Outcomes Research Fellows Program in the Mayo Clinic Kern Center for the Science of Health Care Delivery. He provides mentorship for other fellows and continues to conduct surgical outcomes and quality research—like the current study—in collaboration with the center.