Title: Identifying Psychosocial Predictors Of Opioid Misuse In Chronic Pain Patients Using Machine Learning

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Abstract:
Reducing the risk and prevalence of opioid misuse in pain management is an urgent public health challenge. Improving our understanding of risk factors associated with opioid misuse is an important stepping stone towards this goal. The current study aims to identify key psychosocial risk factors predictive of opioid misuse. Patients with chronic pain (n=314, mean age=54.97, SD=12.11, 76.75% female, 89.8% White) completed measures related to demographics, clinical factors, and cognitive and emotion-coping variables. Opioid misuse severity was assessed using the Current Opioid Misuse Measures (COMM). First, a collection of machine learning models were applied to predict severity of opioid misuse from a total of 51 predictor features. An Elastic Net regression model had shown the best performance, with the mean correlation = 0.61, r^2 = 0.371, $p < 0.001$, RMSE = 4.1 in a 100-fold marte-carlo cross validation. To provide interpretability of the model, we performed a feature ablation analysis: each predictor feature is removed and tested how much the removal reduces the model predictions by calculating the change in correlation score (delta r). Among all the predictors, removing Anger (assessed by PROMIS T scores) had the most reduction in prediction (mean delta r = 0.056, delta r^2 = 0.0031). Notably, ambivalence over emotion expression (AEQ) and pain catastrophizing (PCS) had the second and third most reduction in prediction (mean delta r = 0.0145, 0.012 respectively). The top three impactful features are related to emotion and pain coping, suggesting a potential psychological mechanism underlying opioid misuse in chronic pain. Moreover, it suggests emotion regulation and pain psychology intervention may prevent and intervene opioid misuse in the chronic pain population, and the next step is to examine such hypotheses with clinical trials.