

An AI algorithm to help identify homeless youth at risk of substance abuse

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While many programs and initiatives have been implemented to address the prevalence of substance abuse among homeless youth in the United States, they don't always include data-driven insights about

environmental and psychological factors that could contribute to an individual's likelihood of developing a substance use disorder.

Now, an [artificial intelligence](#) (AI) algorithm developed by researchers at the College of Information Sciences and Technology at Penn State could help predict susceptibility to [substance use disorder](#) among young homeless individuals, and suggest personalized [rehabilitation programs](#) for highly susceptible [homeless youth](#).

"Proactive prevention of substance use disorder among homeless youth is much more desirable than reactive mitigation strategies such as medical treatments for the disorder and other related interventions," said Amulya Yadav, assistant professor of information sciences and technology and principal investigator on the project. "Unfortunately, most previous attempts at proactive prevention have been ad-hoc in their implementation."

"To assist policymakers in devising effective programs and policies in a principled manner, it would be beneficial to develop AI and machine learning solutions which can automatically uncover a comprehensive set of factors associated with substance use disorder among homeless youth," added Maryam Tabar, a doctoral student in informatics and lead author on the project paper that will be presented at the Knowledge Discovery in Databases (KDD) conference in late August.

In that project, the research team built the model using a dataset collected from approximately 1,400 homeless youth, ages 18 to 26, in six U.S. states. The dataset was collected by the Research, Education and Advocacy Co-Lab for Youth Stability and Thriving (REALYST), which includes Anamika Barman-Adhikari, assistant professor of social work at the University of Denver and co-author of the paper.

The researchers then identified environmental, psychological and

behavioral factors associated with substance use disorder among them—such as criminal history, victimization experiences and mental health characteristics. They found that adverse childhood experiences and physical street victimization were more strongly associated with substance use disorder than other types of victimization (such as sexual victimization) among homeless youth. Additionally, PTSD and depression were found to be more strongly associated with substance use disorder than other mental health [disorders](#) among this population, according to the researchers.

Next, the researchers divided their dataset into six smaller datasets to analyze geographical differences. The team trained a separate model to predict substance abuse disorder among homeless youth in each of the six states—which have varying [environmental conditions](#), drug legalization policies and gang associations. The team observed several location-specific variations in the association level of some factors, according to Tabar.

"By looking at what the model has learned, we can effectively find out factors which may play a correlational role with people suffering from substance abuse disorder," said Yadav. "And once we know these factors, we are much more accurately able to predict whether somebody suffers from substance use."

He added, "So if a policy planner or interventionist were to develop programs that aim to reduce the prevalence of substance abuse disorder, this could provide useful guidelines."

Other authors on the KDD paper include Dongwon Lee, associate professor, and Stephanie Winkler, doctoral student, both in the Penn State College of Information Sciences and Technology; and Heesoo Park of Sungkyunkwan University.

Yadav and Barman-Adhikari are collaborating on a similar project through which they have developed a software agent that designs personalized rehabilitation programs for homeless youth suffering from [opioid addiction](#). Their simulation results show that the software agent—called CORTA (Comprehensive Opioid Response Tool Driven by Artificial Intelligence)—outperforms baselines by approximately 110% in minimizing the number of homeless youth suffering from opioid addiction.

"We wanted to understand what the causative issues are behind people developing opiate addiction," said Yadav. "And then we wanted to assign these homeless youth to the appropriate rehabilitation program."

Yadav explained that data collected by more than 1,400 homeless [youth](#) in the U.S. was used to build AI models to predict the likelihood of opioid addiction among this population. After examining issues that could be the underlying cause of opioid addiction—such as foster care history or exposure to street violence—CORTA solves novel optimization formulations to assign personalized rehabilitation programs.

"For example, if a person developed an opioid addiction because they were isolated or didn't have a social circle, then perhaps as part of their rehabilitation program they should talk to a counselor," explained Yadav. "On the other hand, if someone developed an addiction because they were depressed because they couldn't find a job or pay their bills, then a career counselor should be a part of the rehabilitation plan."

Yadav added, "If you just treat the condition medically, once they go back into the real world, since the causative issue still remains, they're likely to relapse."

Yadav and Barman-Adhikari will present their paper on CORTA, "Optimal and Non-Discriminative Rehabilitation Program Design for

Opioid Addiction Among Homeless Youth," at the International Joint Conference on Artificial Intelligence-Pacific Rim International Conference on Artificial Intelligence (IJCAI-PRICAI), which was to be held in July 2020 but is being rescheduled due to the novel coronavirus pandemic.

More information: Amulya Yadav et al. Optimal and Non-Discriminative Rehabilitation Program Design for Opioid Addiction Among Homeless Youth, *Proceedings of the Twenty-Ninth International Joint Conference on Artificial Intelligence* (2020). [DOI: 10.24963/ijcai.2020/605](https://doi.org/10.24963/ijcai.2020/605)

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