

Summary

Using machine learning, we were able to identify firearms at extreme risk for diversion into criminal hands. The most important predictive features include purchaser age and caliber size.

Background

Research on how firearms move from legal purchase to illegal possession and criminal use is limited and outdated and no current systems predict diversion to illegal markets.

Methods

With nearly 8 million legal firearm transaction records in CA from 2010 to 2021 and ~380,000 recovered crime gun records, machine learning prediction was used to predict which firearms were used in crimes shortly after purchase. Purchaser, firearm, and dealer characteristics most predictive of this short time-to-crime gun recovery were also identified.

Findings

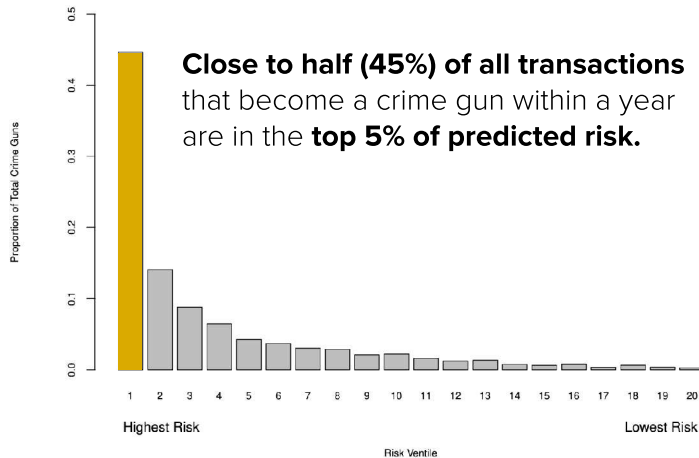
We generated and included **81 purchaser, transaction, retailer, and community-related variables** in our model.

The most important predictive features include:

- purchaser age;
- caliber size;
- firearm type; and
- race/ethnicity.

Overall, the models relatively accurately identify firearms at highest risk for diversion from the legal market for criminal use soon after purchase.

Figure 2: Crime Gun Recovery by Levels of Predicted Risk



Among transactions identified as **extremely risky**, e.g., transactions with a score of 0.98 and above,



74%

74% (35/47 in the test data) were **recovered** within a year.

This study asked:

Can machine learning be used to predict which firearms will be diverted from the legal retail market into the hands of gun offenders?

Big Picture

This is the first study to employ a machine learning approach to predict diversion from legal sale to criminal use.

This study suggests that transaction records may be used in machine learning to identify firearms at highest risk for diversion and criminal use soon after purchase.

The algorithms that we developed are proof of concept. Nonetheless, risk predictions such as this could aid violence prevention efforts by, for example, flagging high risk sales for intervention at the time of firearm purchase or during the 10-day waiting period in states that have them.