Regression Modeling: Predictors of School Discipline Incidents Across Illinois Schools

Capstone

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1 in 4

Illinois ranked the highest for suspension rate of Black students

IL-SB100

Passed in 2015

Question

Using a regression model, can we determine which characteristics of a school are most predictive of suspension and expulsions in Illinois schools?

THE DATA

01

IL STATE BOARD OF EDUCATION (ISBE)

Discipline, demographics (race, EL, low-income), mobility, truancy, financial, math/ELA proficiency

02

### NATIONAL CENTER FOR EDUCATION STATISTICS (NCES)

District size, school region type, charter status, income-to-poverty ratio
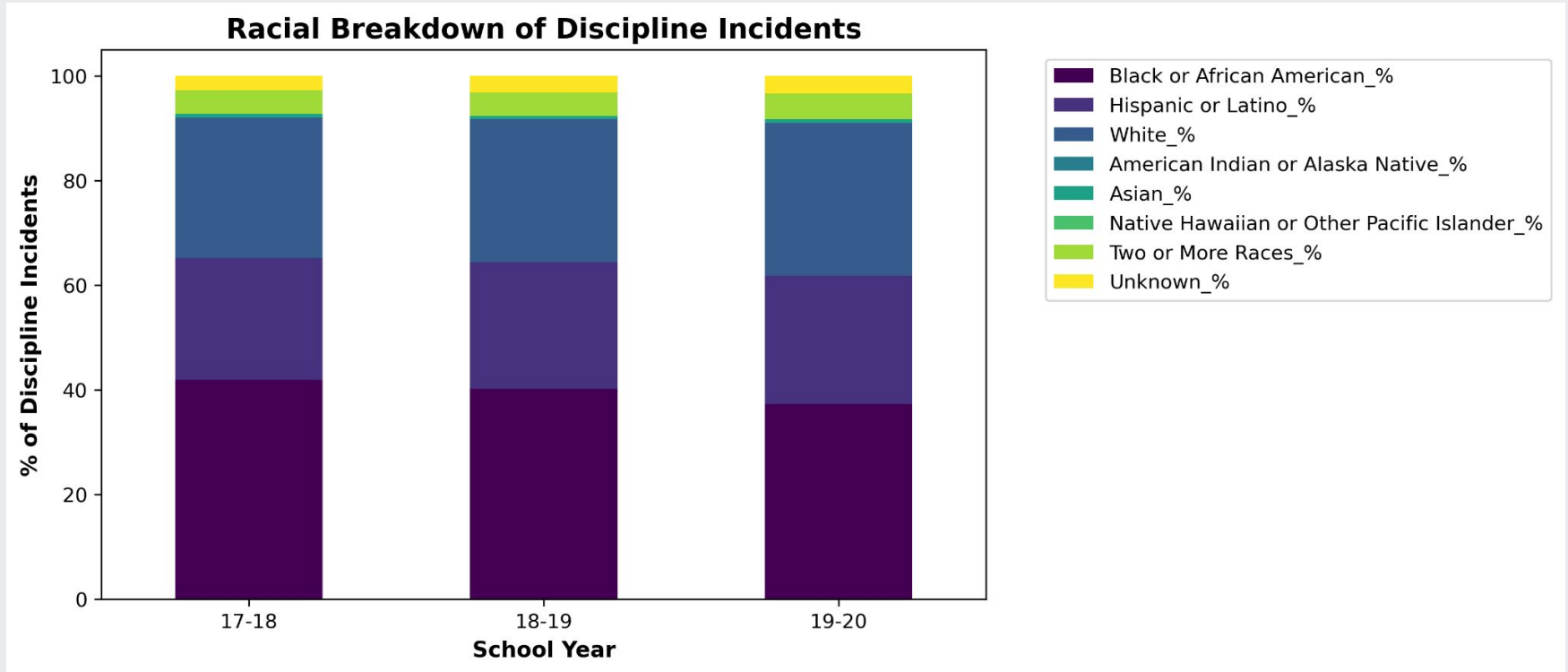
CLEANING/PRE-PROCESSING

○ Standard data cleaning

○ Merged datasets together to create final dataset with all features

○ KNNImputer & SimpleImputer

○ Engineered new features

○ OneHotEncoder

○ VIF (Variance Inflation Factor)

Volume of suspensions and expulsions on the decline across the state

Total Exclusionary Discipline Data 2018-2020
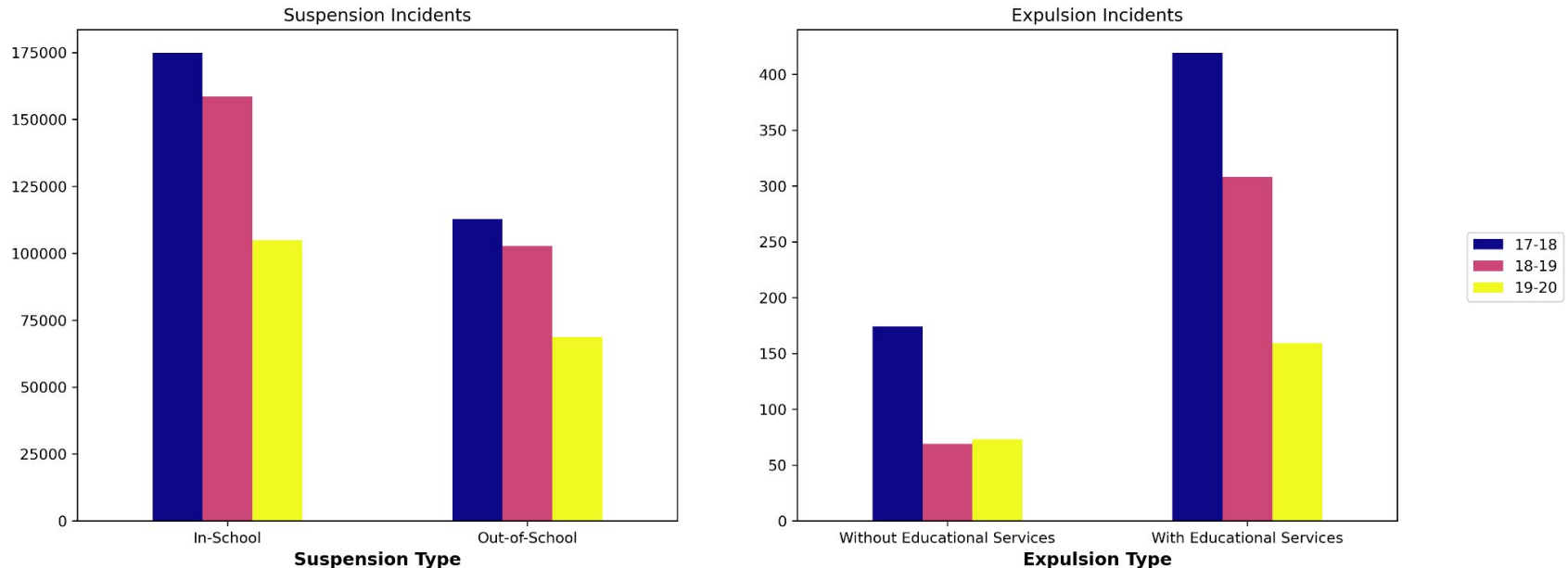
Black & LatinX students continue to make up a higher percentage of discipline incidents.

Racial Breakdown of Discipline Incidents

Legend:
- Black or African American_%
- Hispanic or Latino_%
- White_%
- American Indian or Alaska Native_%
- Asian_%
- Native Hawaiian or Other Pacific Islander_%
- Two or More Races_%
- Unknown_%

Y-axis: % of Discipline Incidents
X-axis: School Year (17-18, 18-19, 19-20)

In Illinois public charter schools, higher % enrollment of Black students show increase in incidents per pupil
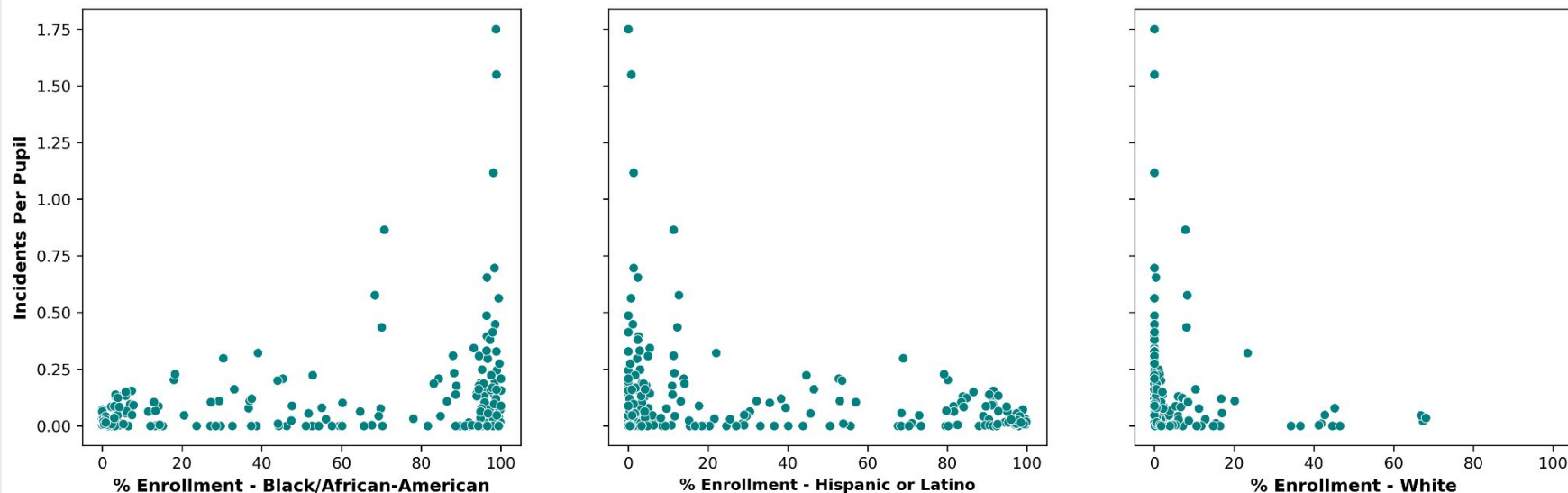
MODELING

- **Model 1 Target -** total volume of discipline incidents
- **Model 2 Target-** discipline incidents per pupil

XGBoost Permutation Feature Importance

➢ Student Attendance Rate

➢ Per Pupil Spending

➢ % of Students - Black or African American

➢ % Math Proficiency - Low Income

School Comparison

	SCHOOL 1	SCHOOL 2
Student Attendance Rate	88.6% →	83.8%
Per Pupil Spending	$8.4K	$8.2K
% of Students Black or African-American	64.9%	64.8%
% Math Proficiency - Low Income	2.5%	2.5%
Incidents Per Pupil	3.1	4.4

School 2 observed 42% higher incidents per pupil value

School Comparison

	SCHOOL 3	SCHOOL 4
Student Attendance Rate	88.9%	88.7%
Per Pupil Spending	$6.4K ➡️	$8.2K
% of Students Black or African-American	44.8%	47.9%
% Math Proficiency - Low Income	2.3%	2.1%
Incidents Per Pupil	**3.5**	**1.0**

School 4 observed 71% lower incidents per pupil value

School Comparison

	SCHOOL 5	SCHOOL 6
Student Attendance Rate	94.4 →	86.1
Per Pupil Spending	$7.4K	$7.4K
% of Students Black or African-American	66.3	63.3
% Math Proficiency - Low Income	16.9% →	2%
Incidents Per Pupil	**2.8**	**3.6**

School 6 observed 29% higher incidents per pupil value

Recommendations & Next Steps

- ISBE should investigate suspension and expulsions in public charter schools

- Before adjusting Title IV funding model, test additional models to see if we can say with more confidence the features do impact discipline incidents
  - Obtain more years of data and at a more granular level
  - Additional feature engineering & selection and test additional models such as a neural net