



# **Outcome Evaluation of the Trade Institute of Pittsburgh's Programs on Recidivism**

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Heinz College Capstone Final Presentation

April 2024

# Presentation Overview

- 1.** *Introduction to the Team & Project*
- 2.** *Review of Midsemester Findings*
- 3.** *Outcome Analysis 2: Methodology & Matching*
- 4.** *Outcome Analysis 2: Results*
- 5.** *Discussion & Recommendations*

# Meet the Team



**Adelyne  
Bejjani**



**Colton  
Lapp**



**Madi  
Zhaksylyk**



**Samira  
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**Victoria  
Ma**

# Project Summary

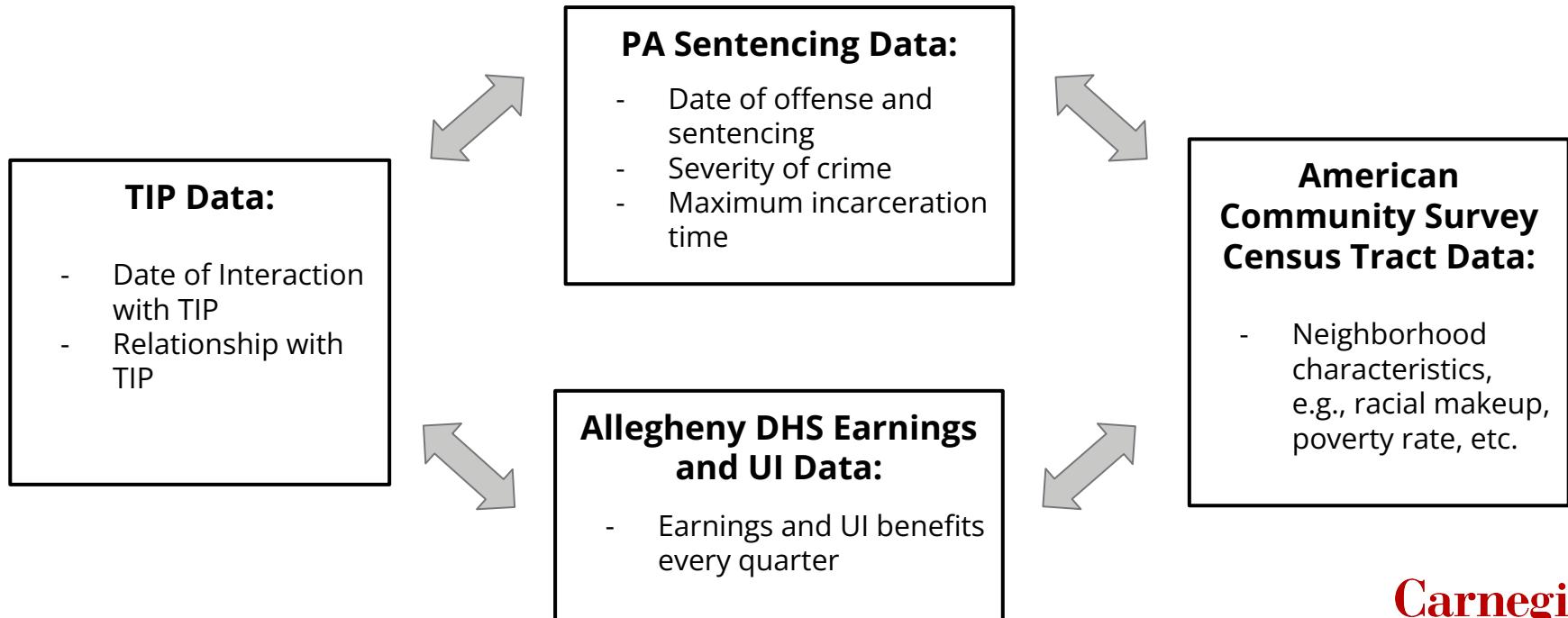
- The **Trade Institute of Pittsburgh** (TIP) is a nonprofit organization and vocational training provider located in the Homewood neighborhood of Pittsburgh
- **Objective:** Evaluate the effect TIP programs have on **reducing recidivism** for their program graduates.



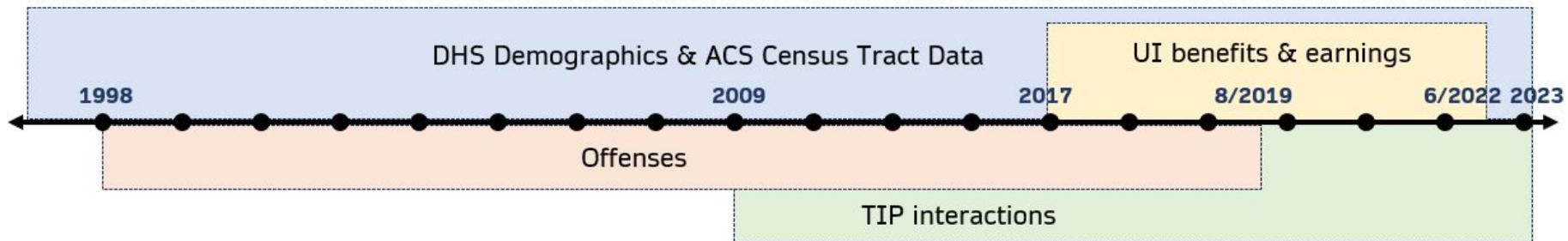
# Project Summary

- **Evaluation Questions:**
  - At what rate do TIP graduates **recidivate** relative to the comparison group?
  - How does this vary with the **severity** of the offense?
- We have **two main outcome analyses**, with **different comparison groups**:
  - Comparing Graduates vs. Nongraduates
  - Comparing Graduates vs. General Allegheny County Population
- We are looking for **statistically significant differences in outcomes** between groups.

# Project Summary: Data



# Project Summary: Data



# Data Limitations and Implications

- We only have useful offense data through **September 2019**:
  - **COVID-19 pandemic** had an impact on crime statistics that is still unclear.
  - Coverage of 2018 convictions data is **limited** due to gap between time of offense and time of sentencing.
  - We **cannot examine 3-years recidivism** for graduation cohorts **after Sept 2016**.
  - We **cannot examine ANY recidivism** for individuals who graduated **after Sept 2018**.
- Data cleaning and data limitations **shrank our dataset**.
  - Started with about 1800 observations; **only 1300** could be defined as TIP graduates and nongraduates.
  - Only had 1-year recidivism outcomes for 547 people and 3-year recidivism outcomes for 297 people.

# Summary of Midsemester Findings

# Important Findings from the Literature

- The research on the impact of workforce training programs on recidivism is **mixed**. When a positive impact is found, it is usually **moderate**.
- This is likely because the impact of workforce training programs on recidivism is **very indirect**. It relies on the individual to first become employed and then also have that employment decrease the individual's risk of recidivism.

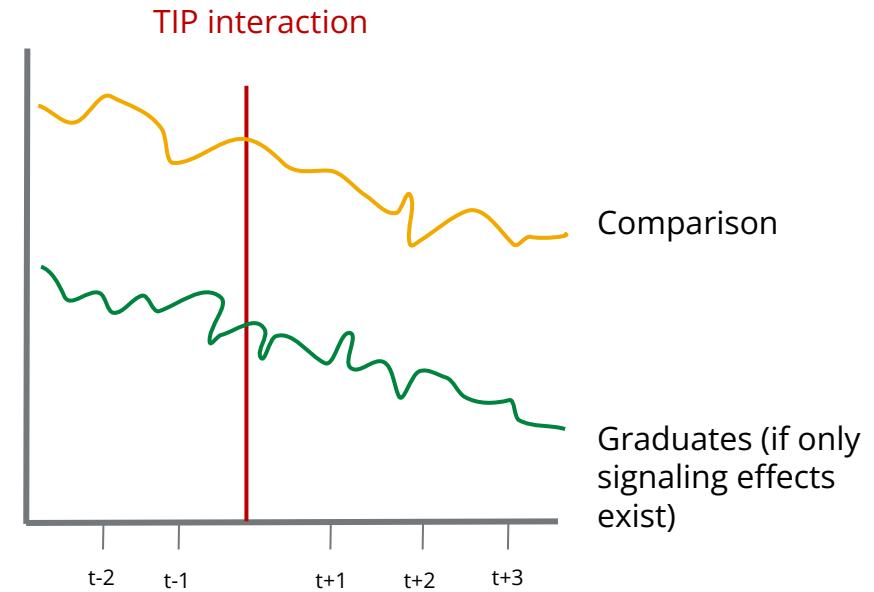
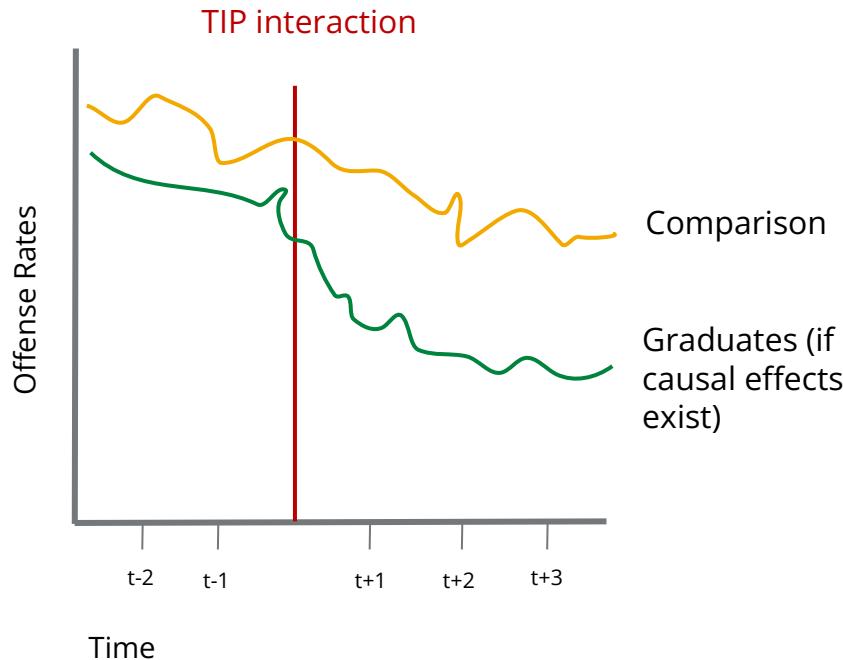


# Important Findings from the Literature

- Still, programs can provide value through **signaling effects** (Bushway & Apel 2012).
  - Individuals who **self-select** into a workforce training program may be more likely to **desist** (stop offending) than those who do not
  - Completing a workforce training program can allow individuals to **signal to employers** that they are desisting



# Causal vs. Signaling Effects



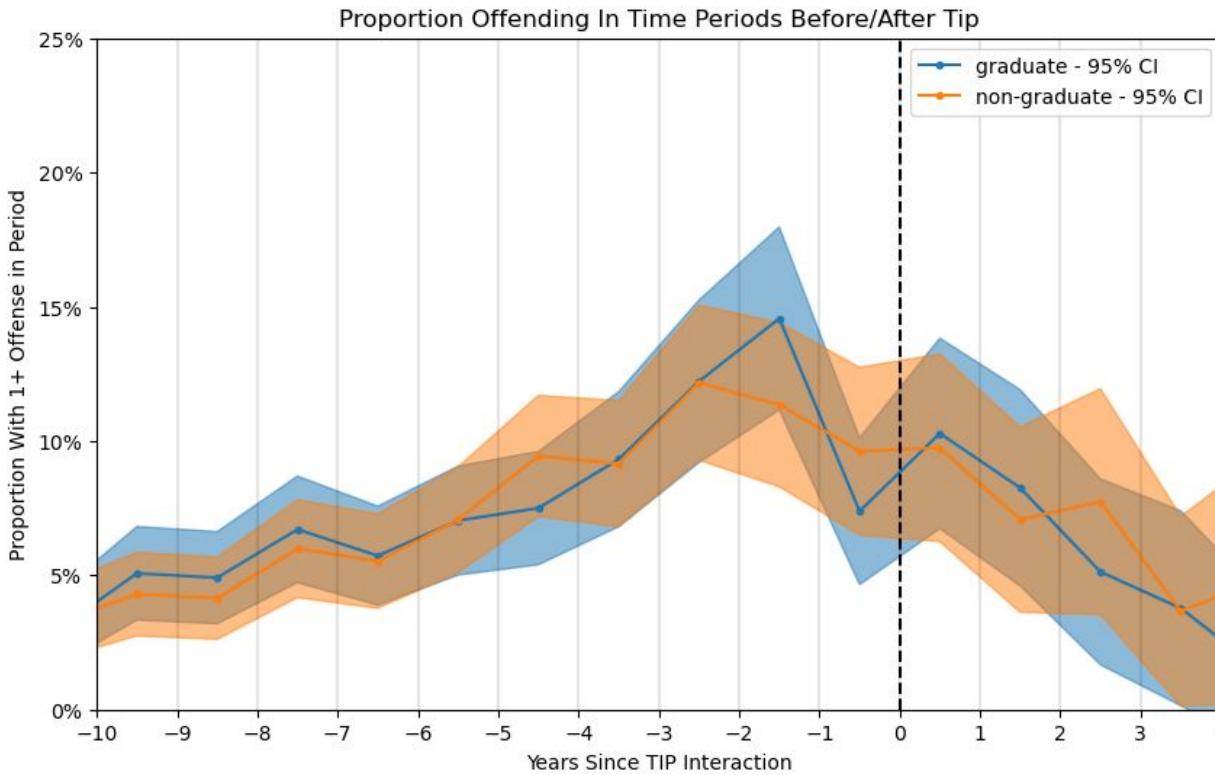
# Outcome Analysis 1: Graduates vs. Nongraduates

- Compared **TIP graduates** to **TIP nongraduates** (those who started but did not finish the TIP program)
  - Similar on observable characteristics, including race, age, and pre-TIP income
  - Key difference: Only one group finished the TIP program
- Consisted of **2 main parts**:
  - **Descriptive analysis:** Are there statistical differences between the two groups in terms of (re)offending post-TIP?
  - **Causal analysis:** Is there evidence of a causal relationship between graduating from TIP and (re)offending?

# Definition of Key Variables

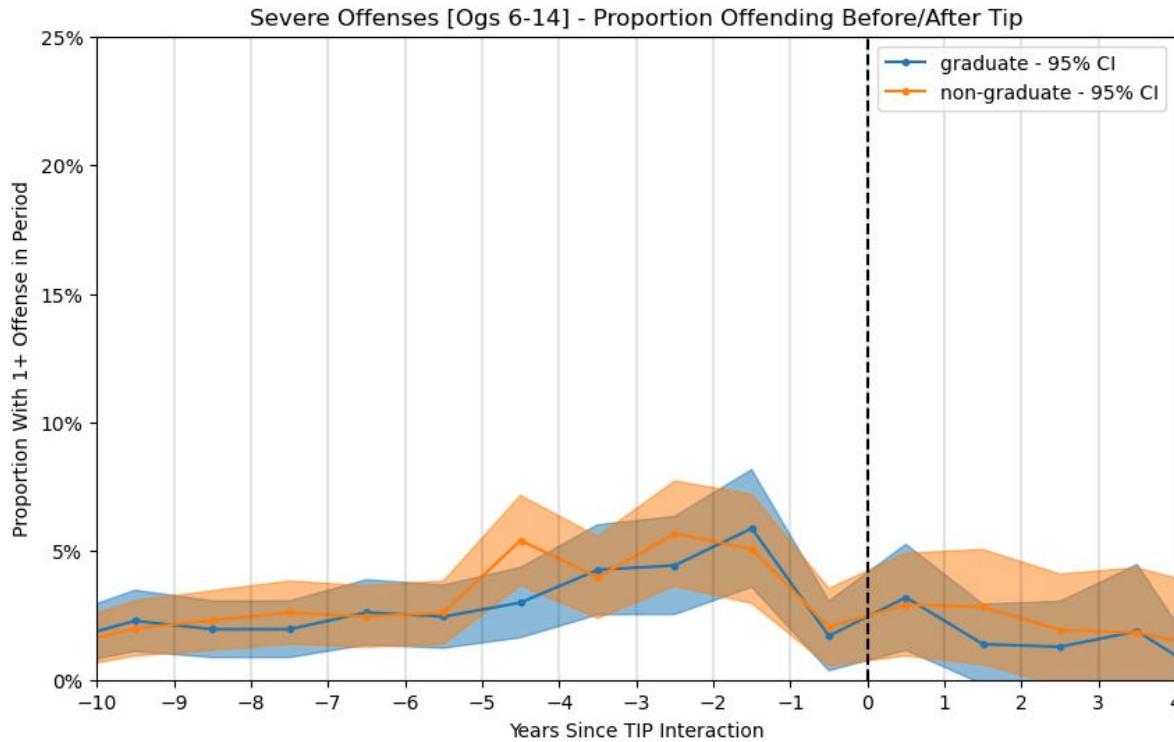
- **Offense rate:** % of group that is **convicted** of an offense committed in X years before or after TIP interaction
- **Severe offense rate:** % of group who have committed an offense with an Offense Gravity Score (**OGS**) of **6 or above** in X years before or after TIP interaction
- **Prior offense:** Indicates whether individual offended **pre-TIP** interaction
- **Time lapse since offense:** Indicates **length of time** between an individual's last offense and their TIP interaction

# Comparison of Offense Rates Over Time



- **Increasing** offense rate *before TIP*
- **Declining** offense rate *after TIP*
- Both groups are **statistically indistinguishable** from each other

# Similar Trend with Severe Offenses (OGS 6+)



- Post TIP, **graduates have lower severe offense rate** (though not statistically significant)
- Pattern is **similar** for less severe offenses

# Results: Causal Analysis

- **No statistically significant effect** of graduating TIP on probability of offending post-TIP

Outcome variable	Graduation (odds)	Age (odds)	pre-TIP offense (odds)
Offense 1 year post-TIP	0.92	0.96	<b>5.89*</b>
Offense 3 years post-TIP	1.16	0.98	<b>4.79*</b>

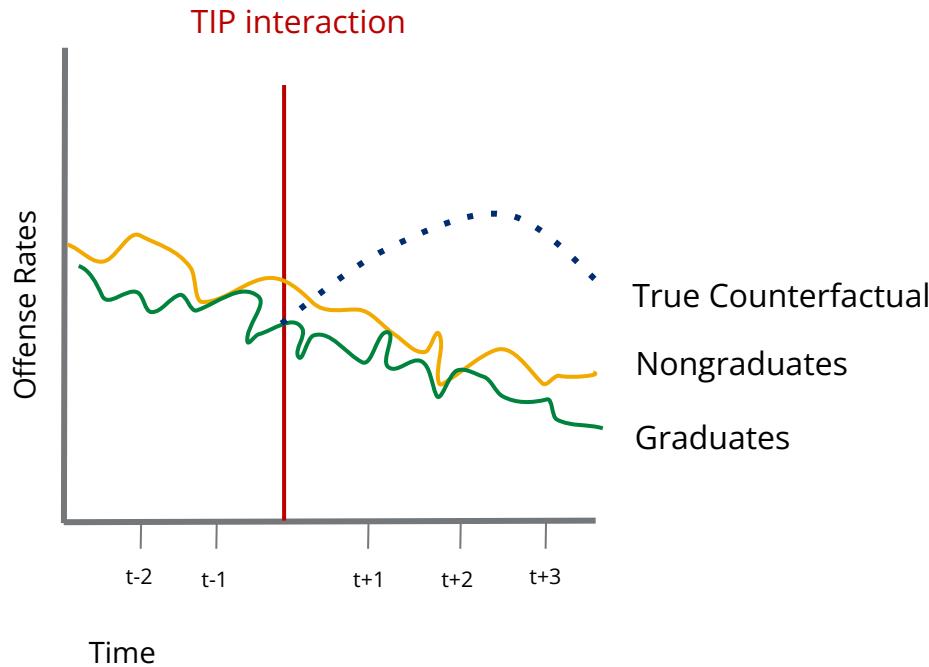
\* Estimate is statistically significant at 95% confidence level (547 and 297 observations)

- No evidence of graduation's impact found when considering only **severe offenses** (Model 2 in Appendix)

# Summary of Outcome Analysis 1 Results

- Causal analyses found **no significant effect** of graduation on offending
- Descriptive analyses found **some differences**, though **statistically insignificant**:
  - Graduates have **lower severe offense rates** post-TIP than nongraduates
  - Both groups demonstrate **lower overall offense rates** post-TIP
- Following this, we had **two options** for our second Outcome Analysis:
  - Find a more **general comparison group** to identify signaling effects
  - Undergo a more complete **causal analysis** of TIP program graduation on **(re)conviction**

# Motivation for Outcome Analysis 2

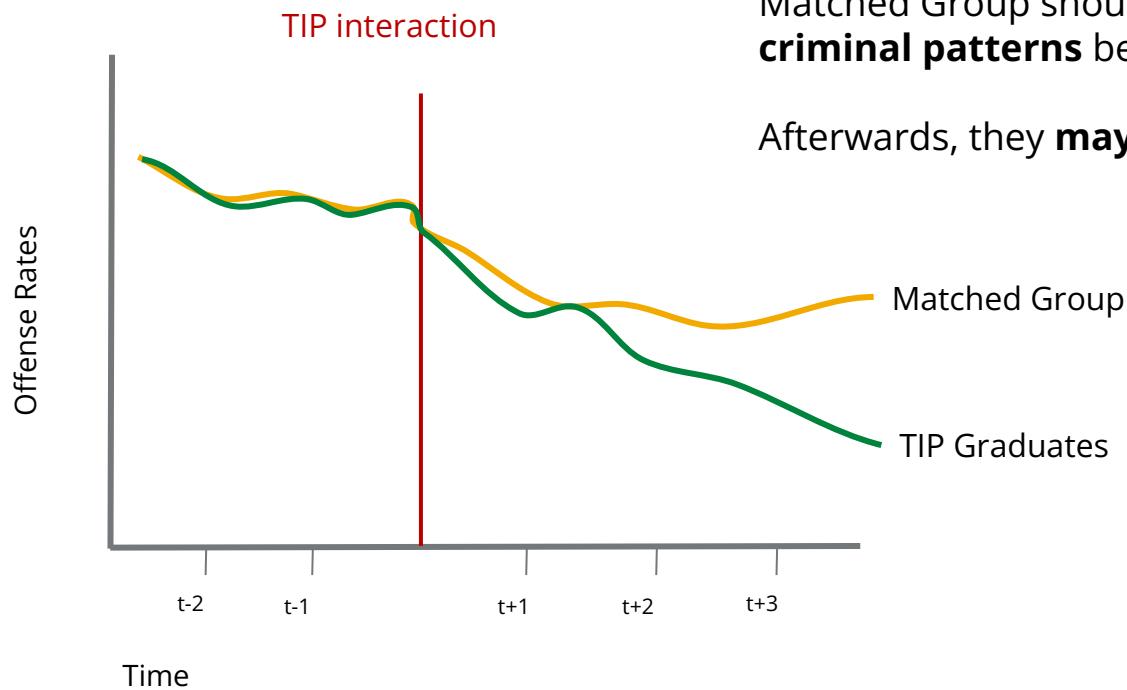


# Outcome Analysis 2

# Graduates vs. General Comparison Group

- Wanted to determine if we can see **statistically significant differences** with a more **general comparison group**
  - Matched to similar individuals in Allegheny County using DHS and PCS data
  - Used these individuals as a type of "**missing counterfactual**" - what our TIP graduates' offense rates would have looked like if they had not entered and completed the TIP program
- **Questions we kept in mind:**
  - At what rate do TIP graduates **recidivate** relative to their Allegheny County counterparts?
  - How does this vary with the **severity** of the offense?

# Expected Results



Matched Group should have **similar criminal patterns** before TIP.

Afterwards, they **may differ**.

# Matching Methodology

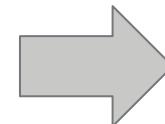
# Outcome Analysis 2: Methodology Overview

- **Goal:** For every TIP graduate with a prior offense, we aimed to find multiple reference people within Allegheny County with similar:
  - Static demographics (e.g., birth year, race, sex)
  - Census tract socio-economic indicators (e.g., poverty rate, unemployment rate)
  - Pre-TIP criminal justice background (e.g., offense in last 3 years)
- Then we compared the **offense rates** between the TIP graduates and the control individuals 1-year and 3-year post-TIP.

# Matching: Overview

## TIP Graduates

**TIP Graduates  
with prior offenses:**  
~200 individuals

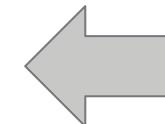


## Matching Criteria

Criminal History

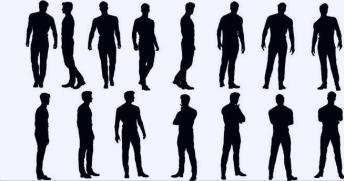
Demographics

Neighborhood  
Characteristics

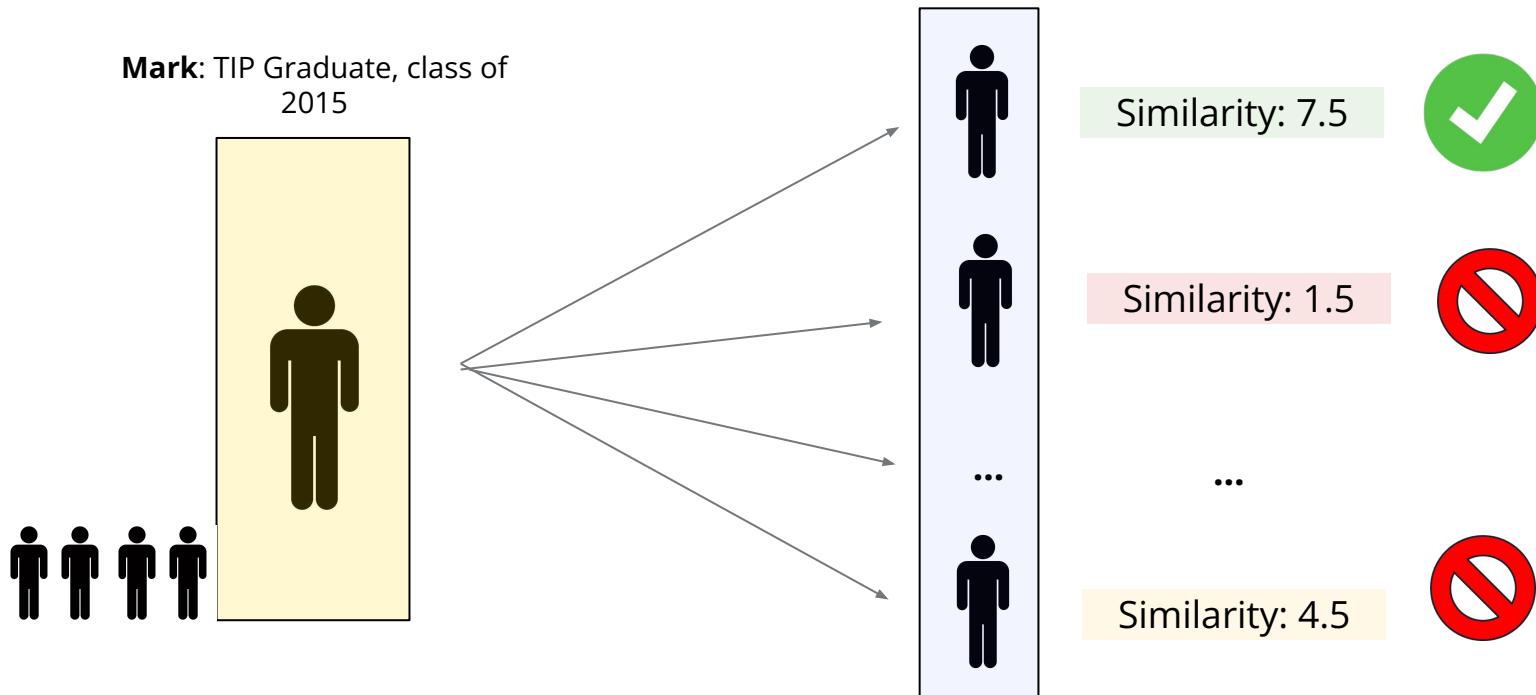


## Control Population

**Allegheny County  
Residents with  
Criminal Histories**  
~63,000 people



**For each TIP Graduate, we compute “similarity scores” with all Allegheny County Residents.**



# Similarity scores are a weighted sum of overlapping characteristics.

**Mark:** TIP Graduate, class of 2015

	Birth Year	1987
	Race	Black
	Sex	Male
	Severe offense from 2012-2014	Yes
	Minor offense from 2010-2012	Yes
	...	...
	Neighborhood Poverty:	25%
	Neighborhood Unemployment:	8%

Weights:	Scores:
2	+ 2
1	+ 0
1	+ 1
2	+ 0
2	+ 2
	...
1	+ 0.5
.5	+ 0
<b>Similarity Score Total:</b>	
<b>5.5</b>	

**Louis:** Local Resident

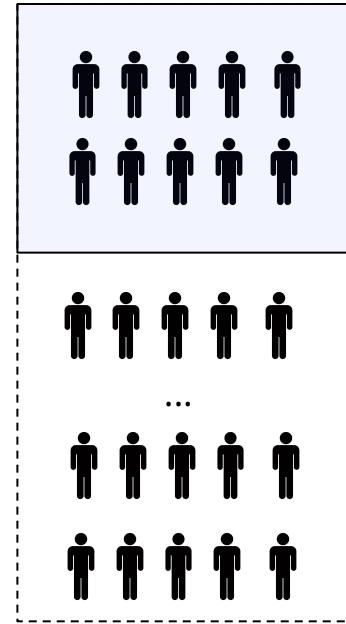
Birth Year	1986	
Race	White	
Sex	Male	
Severe offense from 2012-2014	No	
Minor offense from 2010-2012	Yes	
...	...	
Neighborhood Poverty:	16%	
Neighborhood Unemployment:	3%	

# Each TIP Graduate is Matched to the 10 Closest Individuals

Mark: TIP Graduate, class of 2015

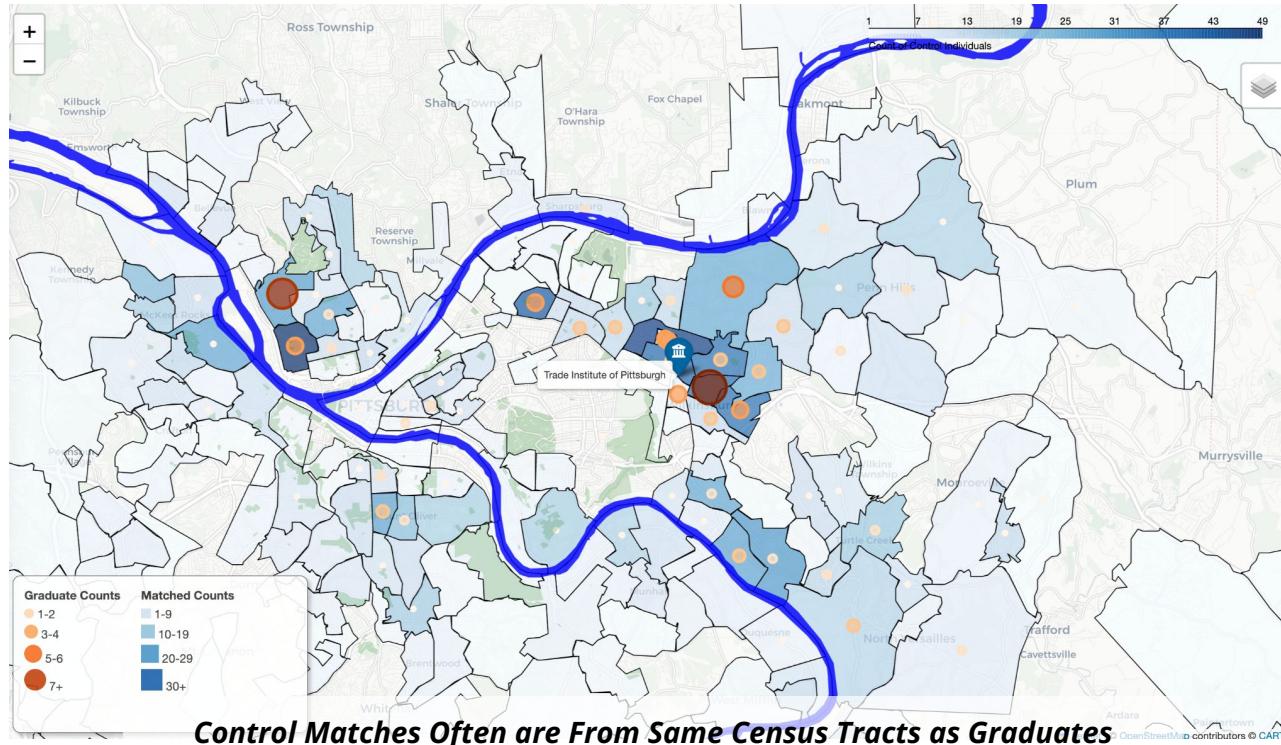


	Birth Year	1987
	Race	Black
	Sex	Male
	Severe offense from 2012-2014	Yes
	Minor offense from 2010-2012	Yes
...	...	
	Neighborhood Poverty:	25%
	Neighborhood Unemployment:	8%



# Matching Results: Geographic

Map of Where Comparison Group Lives



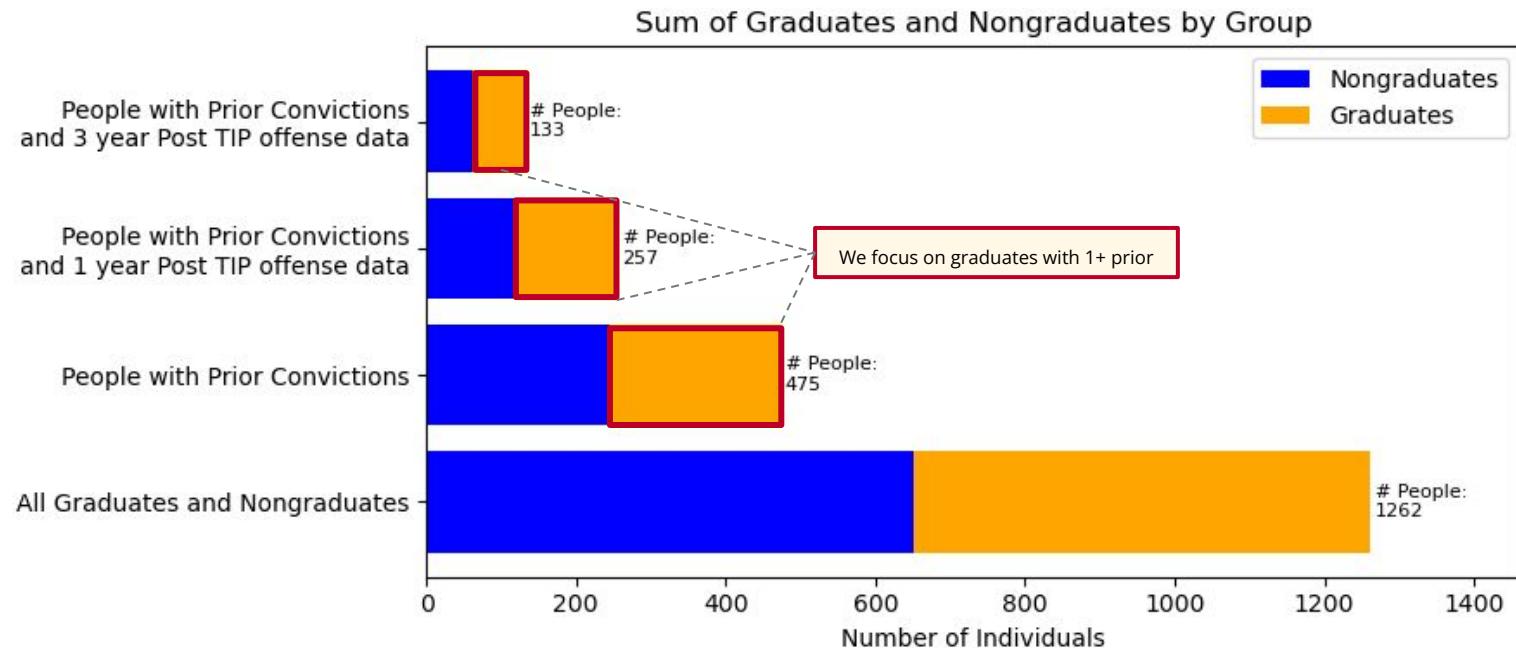
- We successfully found **10 distinct matches** for every TIP graduate
- Control matches look **very similar** along demographics, neighborhood characteristics and criminal histories

# Matching Results: Statistics of Matched Group

	Percent Matching	TIP Graduates (n=186)	Control matches (n=1860)
<b>Race</b>	<b>94%</b>	Black = 82%	Black = 83%
<b>Sex</b>	<b>93%</b>	Male = 86%	Male = 91%
<b>Any Offense</b> before TIP 0-1 years, 1-2 years, 2-5 years, 5-10 years	<b>91%, 100%, 99%, 100%</b>	No Offense = 84%, 74%, 50%, 57%	No offense = 87%, 74%, 50%, 57%
<b>Severe Offense</b> before TIP 0-1 years, 1-2 years, 2-5 years	<b>92%, 100%, 100%</b>	No Offense = 91%, 88%, 71%	No offense = 92%, 88%, 71%
<b>Birth Year</b>	<b>99% Within +/- 2 years</b>	Mean Birth Year = 1986	Mean Birth Year = 1986
<b>Difference in Neighborhoods:</b> Income, Rent, %Black, Poverty Rate, Unemployment Rate, High School Education	Z score differences: 0.01, 0.05, 0.14, 0.02, 0.03, -0.09	-.72, -.45, 1.35, 0.66, 0.66, -0.29	-.72, -.49, 1.19, 0.63, 0.62, -0.19

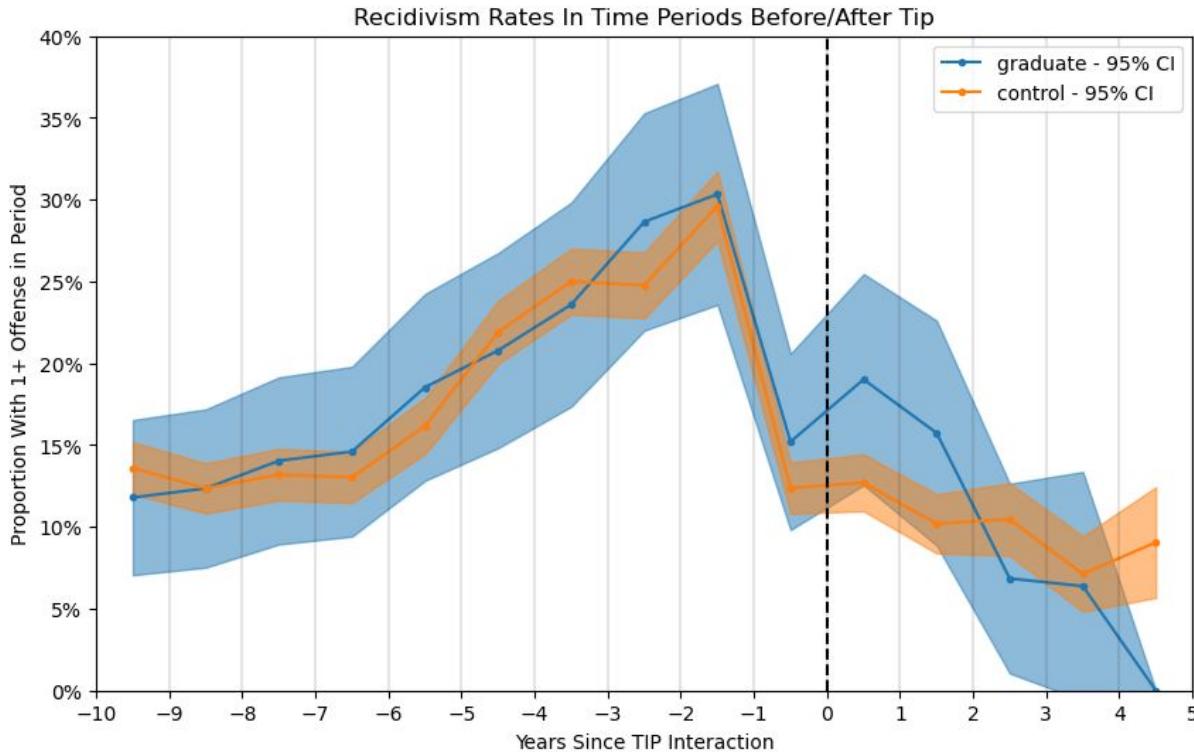
- We successfully found **10 distinct matches** for every TIP graduate
- Control matches look **very similar** along demographics, neighborhood characteristics and criminal histories

*Note: Restricting our analysis to Graduates with 1+ prior limits our sample size and the scope of our findings*



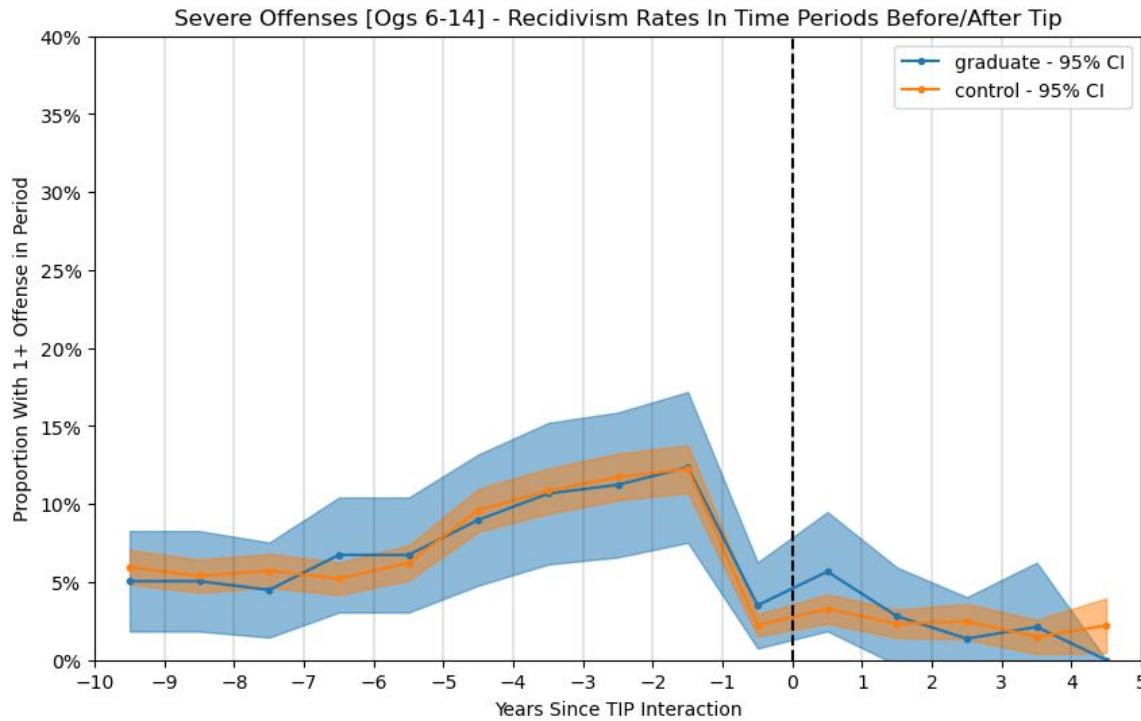
# Outcome Analysis 2 Results

# Results: Overall Recidivism Rates



- General **downward trend** in the post-TIP period
- **No distinct difference** in the offense pattern between groups

# Results: Severe Recidivism Rates



- Severe offense patterns are also **broadly similar** between groups.

# Regression Analysis: Methodology

- Comparing Graduates with 1 or more prior convictions to the matched comparison group
- **Outcome variables:**
  - 1-year reoffense rates, severe/non-severe (*141 graduates*)
  - 3-year reoffense rates, severe/non-severe (*73 graduates*)
- **Controlled for:**
  - Age at TIP
  - Recent prior offense (within 3 years)
  - Occurrence of severe prior offense (OGS 6+)
  - Number of prior offenses

# Regression Results: Graduates vs Matched Controls

## Lack of Signaling Effect of TIP

Comparing graduates with priors and our matched control sample **never** indicates that being a graduate is associated with **lower risk**.

# Regression Results: Graduates vs Matched Controls

## Lack of Signaling Effect of TIP

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### Consistent Risk Factors:

#### Younger Age

*Each additional year reduces risk by 0.5 - 1 p.p.*

#### Higher Number of Priors

*Each additional prior increases risk by 3 - 5 p.p.*

### Mixed Evidence Risk Factors:

#### More Recent Prior

*Sometimes associated with ~5 p.p. increase in risk*

# Summary of Outcome Analysis 2 Results

- **No evidence of a signaling effect** between TIP graduates and the Allegheny County comparison group
  - This holds for **any offenses and severe offenses** within 1 and 3 years after TIP
- This is reaffirmed by our regression analyses: there are **no evidence** that graduation status is associated with lower risk for the subsample
- Regression analyses did show significant effects for the **number of prior offenses, age**, and **time since last conviction**

# Discussion & Recommendations

# Discussion

- **Small sample size** may have limited our ability to detect a true effect and find statistical significance, as indicated by the wide confidence bands.
- We are looking at an **old version of TIP**.
  - Because of 2020 and onwards data unavailability, we were **unable to evaluate offense rates for TIP graduates after 2018**.
  - The **program has evolved**, and newer strategies might be more effective at reducing recidivism, which our data doesn't capture.

# Recommendations for Further Research

- Conduct analyses that include **more recent versions of the program**.
  - This will provide a **larger sample size** and gauge whether **adjustments made in recent years** have an effect on recidivism.
- **Qualitatively investigate** why graduates recidivate after completing the TIP program.
  - **Interviewing graduates who reoffended** to get more context may be helpful for determining program improvements.



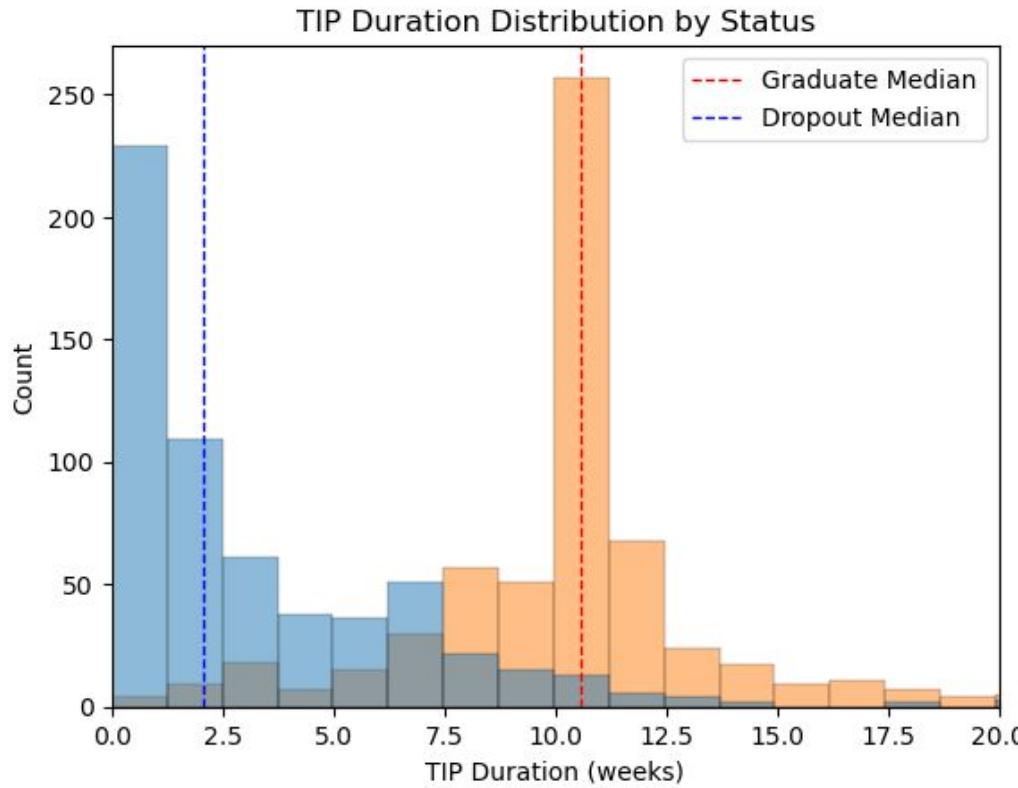
# Recommendations for Programming

- Continue **checking in on graduates post-graduation** to ensure there is not a steep drop in support they experience.
- Incorporate services into programming that focus on **risk factors for recidivism outside employment**, such as substance abuse, antisocial attitudes, and lack of leisure/recreation outside of illegal activities.
- Target services for reducing recidivism more strongly to those with the **highest risk of recidivism** - those who are younger, have a higher number of prior convictions, and/or have a more recent conviction.

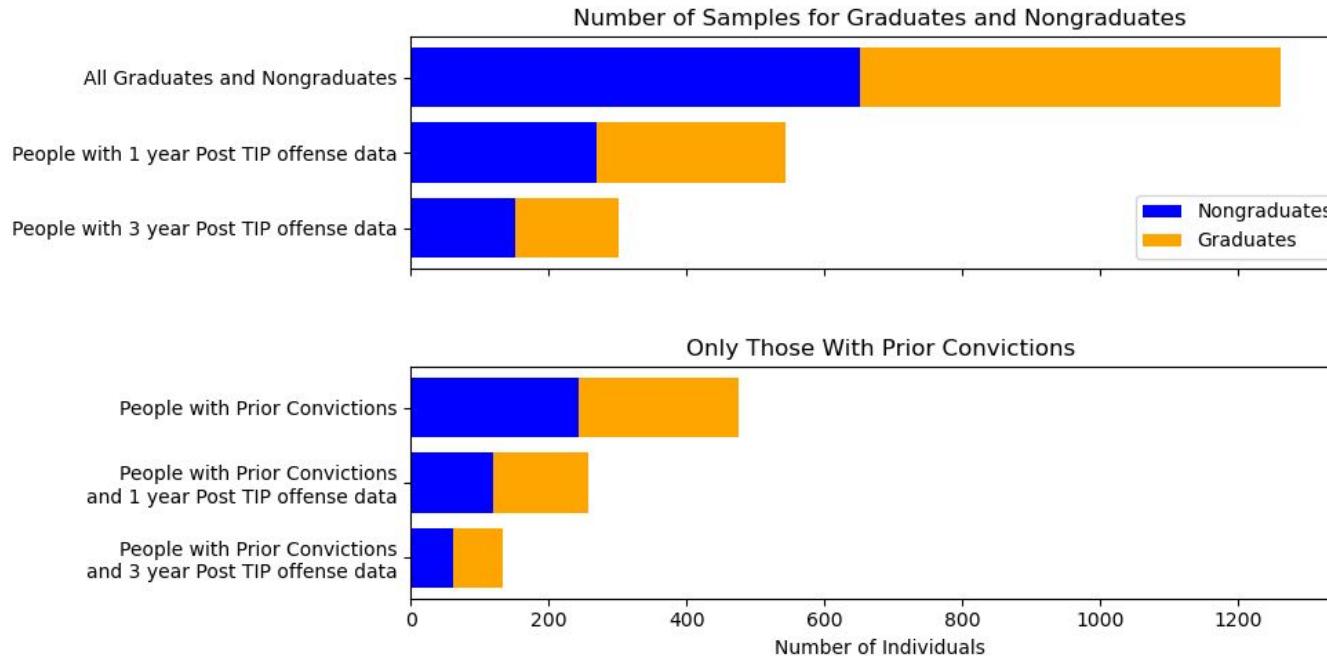
# Thank You!

# Appendix

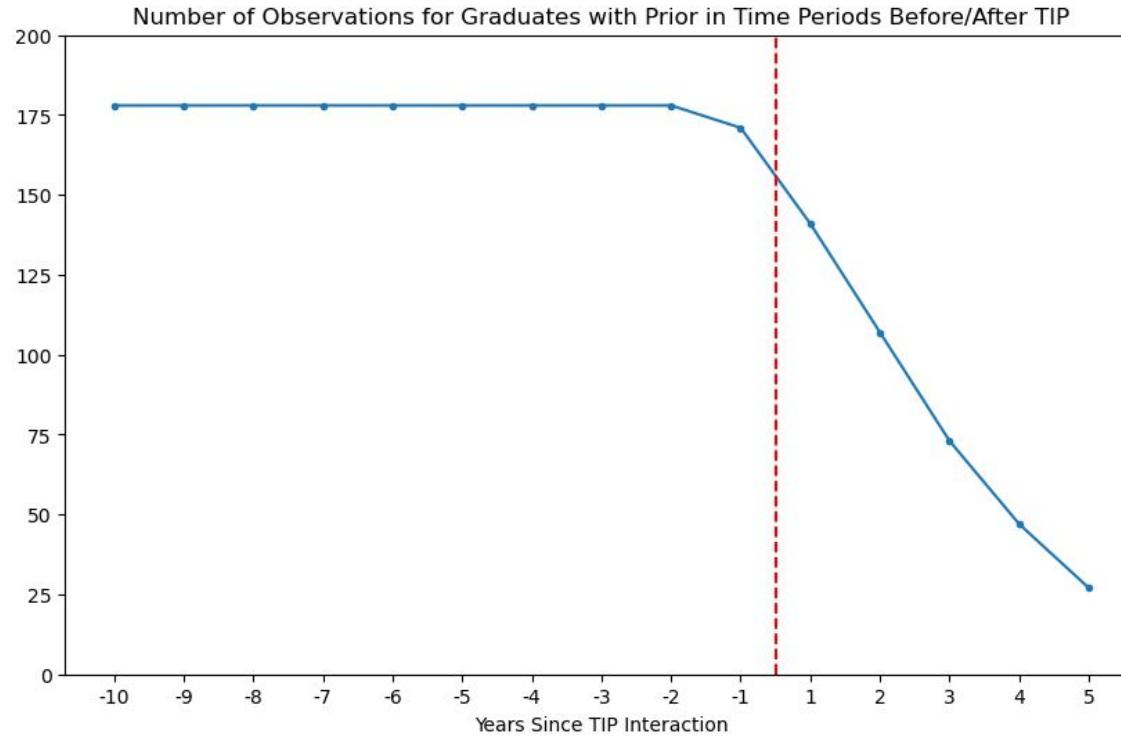
# How long are graduates and non graduates in program?



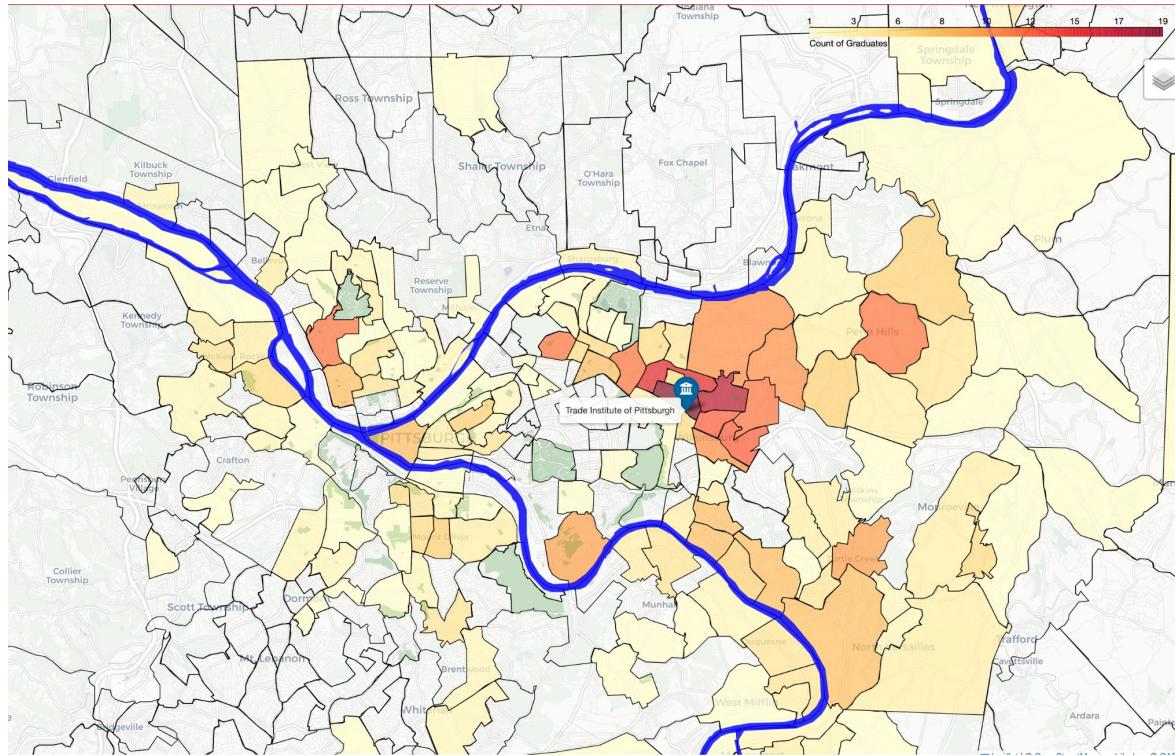
# Sample Size Analysis



# Outcome Analysis 2: Sample Size for Offense Rates



# Map of Graduates Census Tracts



# Matching Results - Descriptive Analysis

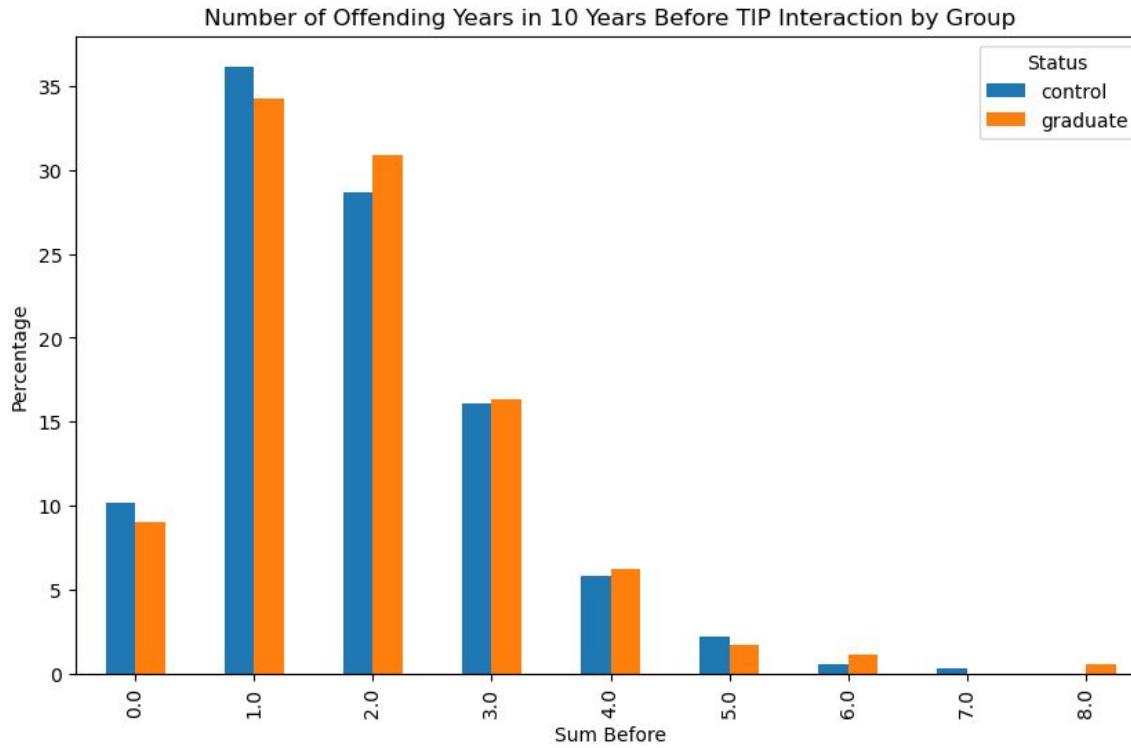
# Final Matching Criteria: Demographics, Socio-economic, and Criminal Background

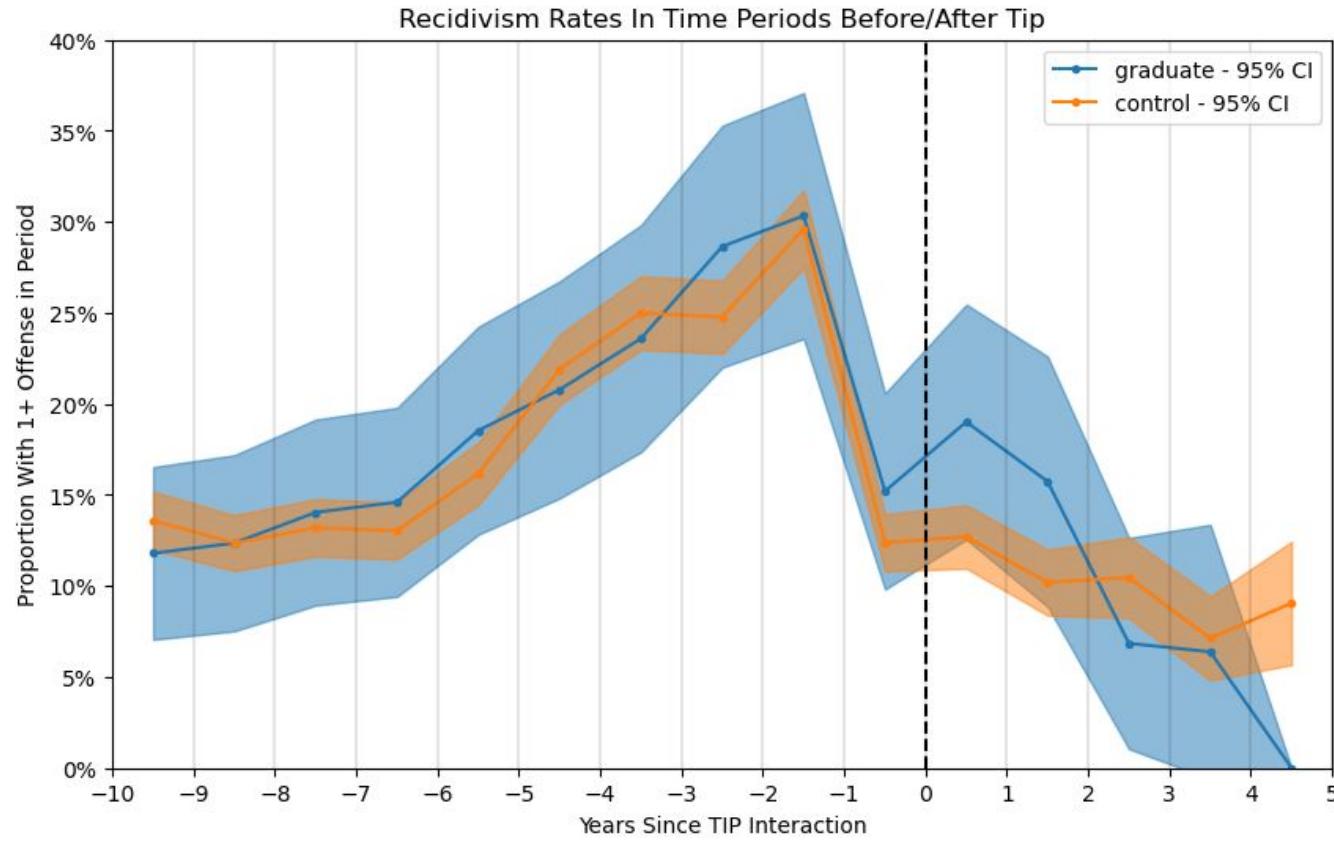
50

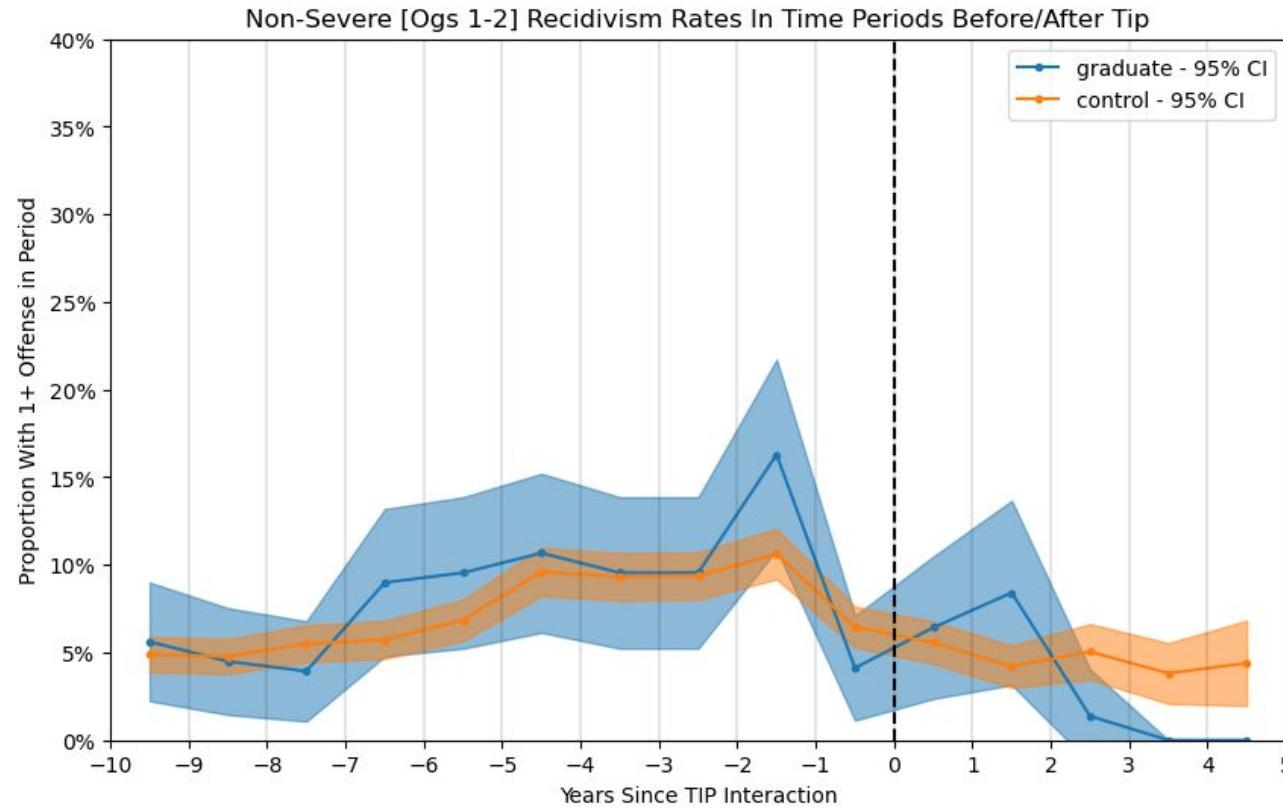
Category	Variable	Weight
NEIGHBORHOODS	Median_Household_Income	0.2
	Median_Rent	0.2
	Percent_Black	0.4
	Percent_High_School_or_Less	0.4
	Poverty_Rate	0.4
	Unemployment_Rate	0.2
DEMOGRAPHICS	birth_year	1.5
	census_tract	0.1
	gender	1.0
	race	1.0
CRIMINAL HISTORY	of_Oto4yr_misdemeanor_and_up	1.0
	of_1to2yr_before_tip_any	2.0
	of_1to2yr_before_tip_severe	2.0
	of_1yr_before_tip_any	1.25
	of_1yr_before_tip_severe	1.25
	of_2to5yr_before_tip_any	1.5
	of_2to5yr_before_tip_severe	1.5
	of_5to10yr_before_tip_any	1.5
	of_5to10yr_before_tip_severe	1.5
	of_5to10yr_misdemeanor_and_up	1.0

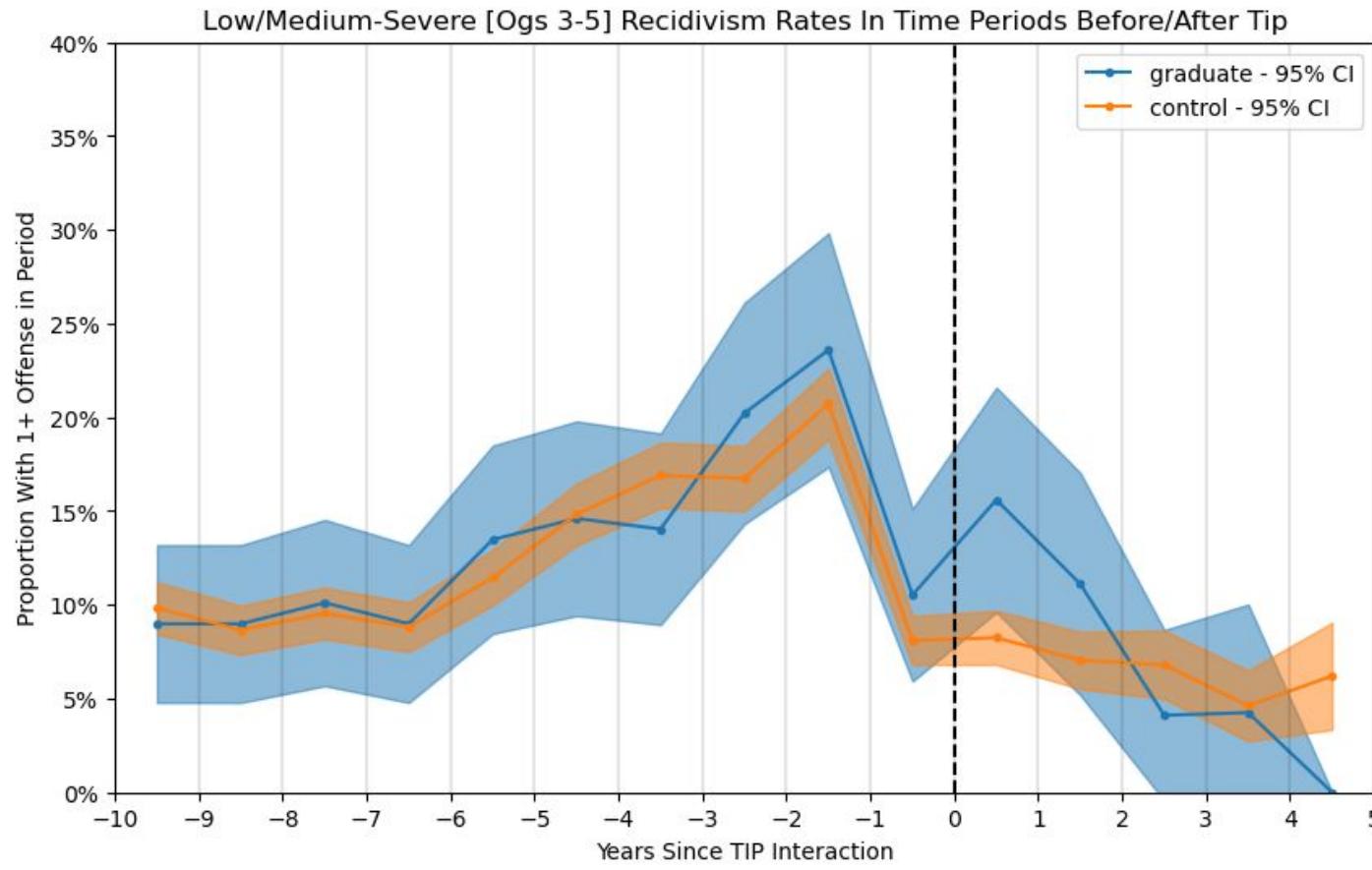
## Average number of "Offending Years" for Grads/Control Population in 10 Years Before TIP

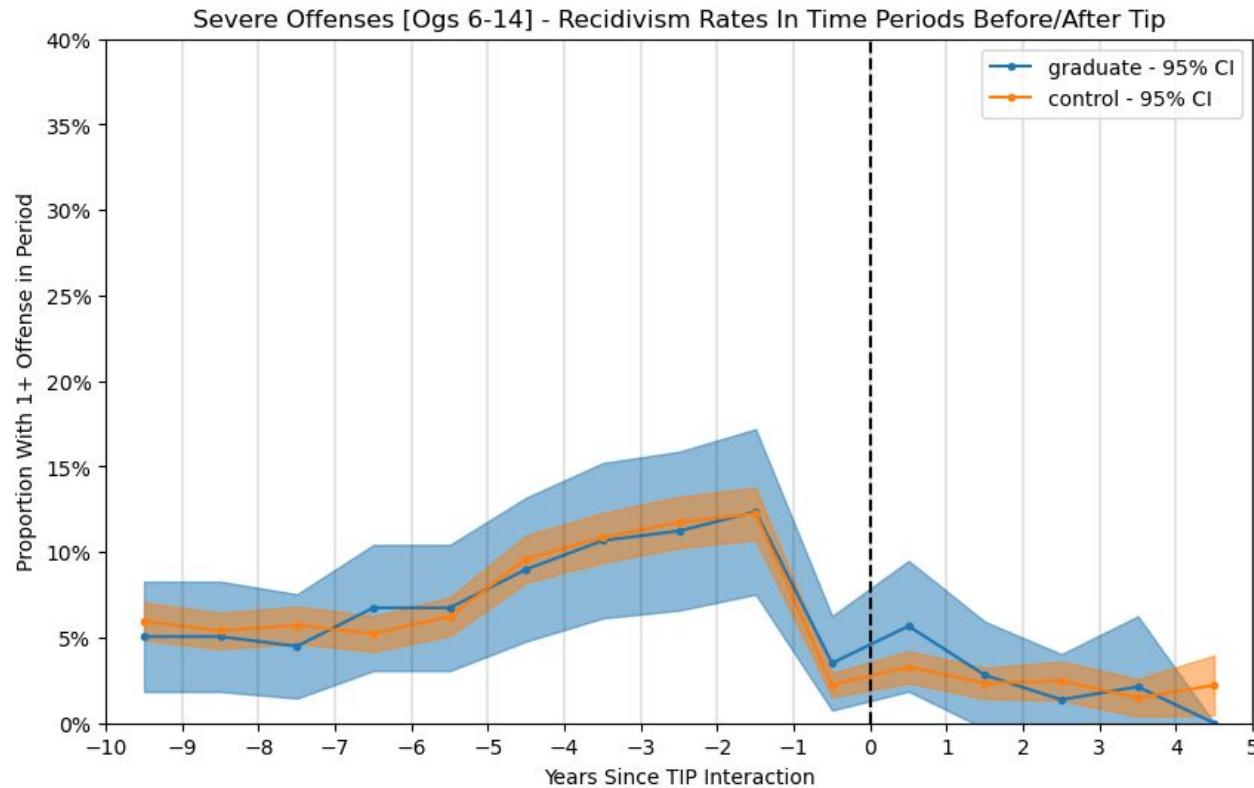
*Most people only offend in 1-3 of the 10 years before TIP*











# Matching Results - Regression Analysis

# Graduates vs Matched Controls - 1 Year Recidivism

Number of people with program_graduate == 1: 141							
OLS Regression Results							
Dep. Variable:	post_conviction_1_years_ogs3_and_up		R-squared:	0.037			
Model:		OLS	Adj. R-squared:	0.034			
Method:		Least Squares	F-statistic:	11.63			
Date:	Sat, 27 Apr 2024		Prob (F-statistic):	4.82e-11			
Time:	13:49:28		Log-Likelihood:	-299.80			
No. Observations:	1532		AIC:	611.6			
Df Residuals:	1526		BIC:	643.6			
Df Model:	5						
Covariance Type:	nonrobust						
	coef	std err	t	P> t	[0.025	0.975]	
const	0.1632	0.051	3.195	0.001	0.063	0.263	
program_graduate	0.0786	0.026	3.016	0.003	0.027	0.130	
age_at_tip	-0.0040	0.002	-2.644	0.008	-0.007	-0.001	
prior_3_year_ogs3_and_up	0.0417	0.017	2.461	0.014	0.008	0.075	
prior_high_conviction_all_time	-0.0513	0.019	-2.692	0.007	-0.089	-0.014	
num_priors_OGS3_and_up	0.0260	0.006	4.650	0.000	0.015	0.037	
Omnibus:	759.943	Durbin-Watson:	1.986				
Prob(Omnibus):	0.000	Jarque-Bera (JB):	3082.313				
Skew:	2.524	Prob(JB):	0.00				
Kurtosis:	7.775	Cond. No.	212.				
Notes:							
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.							

- **TIP Graduate:** 8% Higher Risk\*\*
- **Higher Age:** .4% Lower Risk per Year\*\*
- **Higher prior count:** 3% Higher risk per prior\*\*\*
- **Recent prior:** 4% Higher Risk \*
- **“Severe” prior:** 5% Lower Risk\*  
*(Possibly due to being incarcerated)*

# Graduates vs Matched Controls - 3 Year Recidivism

Number of people with program_graduate == 1: 73							
<i>- No Effect</i>							
OLS Regression Results							
Dep. Variable:	post_conviction_3_years_ogs3_and_up	R-squared:	0.047				
Model:	OLS	Adj. R-squared:	0.041				
Method:	Least Squares	F-statistic:	7.833				
Date:	Sat, 27 Apr 2024	Prob (F-statistic):	3.29e-07				
Time:	13:49:29	Log-Likelihood:	-423.07				
No. Observations:	798	AIC:	858.1				
Df Residuals:	792	BIC:	886.2				
Df Model:	5						
Covariance Type:	nonrobust						
	coef	std err	t	P> t	[0.025	0.975]	
const	0.4214	0.095	4.444	0.000	0.235	0.607	
program_graduate	0.0804	0.051	1.585	0.113	-0.019	0.180	
age_at_tip	-0.0094	0.003	-3.231	0.001	-0.015	-0.004	
prior_3_year_ogs3_and_up	0.0402	0.032	1.241	0.215	-0.023	0.104	
prior_high_conviction_all_time	-0.0644	0.037	-1.750	0.081	-0.137	0.008	
num_priors_OGS3_and_up	0.0452	0.011	4.062	0.000	0.023	0.067	
Omnibus:	129.436	Durbin-Watson:	1.982				
Prob(Omnibus):	0.000	Jarque-Bera (JB):	192.122				
Skew:	1.191	Prob(JB):	1.91e-42				
Kurtosis:	2.679	Cond. No.	204.				
Notes:							
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.							

- **TIP Graduate: No Effect**
- **Higher Age:** 1% Lower Risk per Year\*\*\*
- **Higher prior count:** 5% Higher risk per prior\*\*\*
- **Recent prior:** No Effect
- **"Severe" prior:** No Effect

# Graduates vs Matched Controls - 1 Year Severe Recidivism

... Number of people with program_graduate == 1: 141						
... OLS Regression Results						
Dep. Variable: post_high_conviction_1_years R-squared: 0.021						
Model: OLS Adj. R-squared: 0.018						
Method: Least Squares F-statistic: 6.554						
Date: Sat, 27 Apr 2024 Prob (F-statistic): 4.83e-06						
Time: 14:42:44 Log-Likelihood: 443.23						
No. Observations: 1528 AIC: -874.5						
Df Residuals: 1522 BIC: -842.5						
Df Model: 5						
Covariance Type: nonrobust						
	coef	std err	t	P> t	[0.025	0.975]
const	0.1131	0.031	3.595	0.000	0.051	0.175
program_graduate	0.0242	0.016	1.510	0.131	-0.007	0.056
age_at_tip	-0.0034	0.001	-3.672	0.000	-0.005	-0.002
prior_3_year_ogs3_and_up	0.0072	0.010	0.688	0.491	-0.013	0.028
prior_high_conviction_all_time	-0.0081	0.012	-0.684	0.494	-0.031	0.015
num_priors_OGS3_and_up	0.0099	0.003	2.870	0.004	0.003	0.017
Omnibus: 1488.006 Durbin-Watson: 1.952						
Prob(Omnibus): 0.000 Jarque-Bera (JB): 39361.819						
Skew: 4.923 Prob(JB): 0.00						
Kurtosis: 25.832 Cond. No. 212.						
Notes:						
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.						

- **TIP Graduate: No Effect**
- **Higher Age: .3% Lower Risk per Year\*\*\***
- **Higher prior count: 1% Higher risk per Prior\*\*\***
- **Recent prior: No Effect**
- **"Severe" prior: No Effect**

# Graduates vs Matched Controls - 3 Year Severe Recidivism

```

... Number of people with program_graduate == 1: 73

...
            OLS Regression Results
Dep. Variable: post_high_conviction_3_years    R-squared:      0.036
Model:                 OLS    Adj. R-squared:     0.030
Method:                Least Squares    F-statistic:     5.883
Date:        Sat, 27 Apr 2024    Prob (F-statistic): 2.39e-05
Time:          14:44:55    Log-Likelihood:   -49.414
No. Observations:      794    AIC:             110.8
Df Residuals:         788    BIC:             138.9
Df Model:                  5
Covariance Type:    nonrobust
                        coef  std err      t    P>|t| [0.025  0.975]
const           0.2166  0.059   3.642  0.000   0.100   0.333
program_graduate 0.0390  0.032   1.229  0.219  -0.023   0.101
age_at_tip      -0.0063  0.002  -3.479  0.001  -0.010  -0.003
prior_3_year_ogs3_and_up 0.0116  0.020   0.571  0.568  -0.028   0.052
prior_high_conviction_all_time -0.0115  0.023  -0.496  0.620  -0.057   0.034
num_priors_OGS3_and_up 0.0206  0.007   2.953  0.003   0.007   0.034
Omnibus: 508.193    Durbin-Watson: 2.020
Prob(Omnibus): 0.000    Jarque-Bera (JB): 3313.854
Skew: 3.069    Prob(JB): 0.00
Kurtosis: 10.906    Cond. No. 203.

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

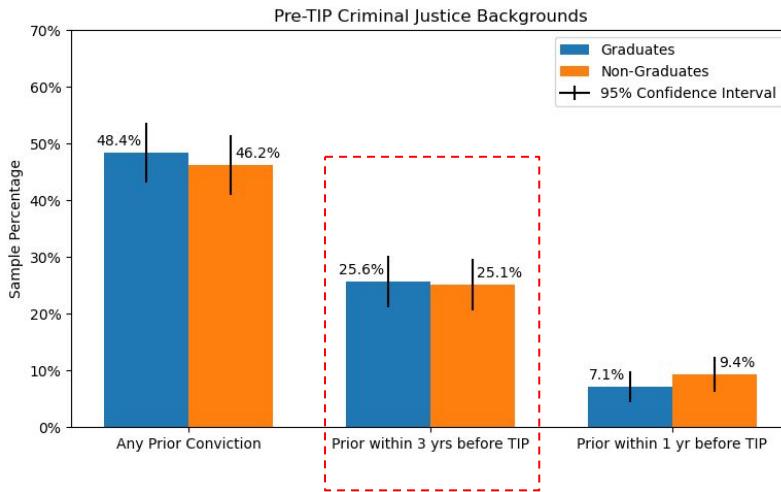
```

- **TIP Graduate: No Effect**
- **Higher Age:** .6% Lower Risk per Year\*\*\*
- **Higher prior count:** 2% Higher risk per Prior\*\*\*
- **Recent prior: No Effect**
- **"Severe" prior: No Effect**

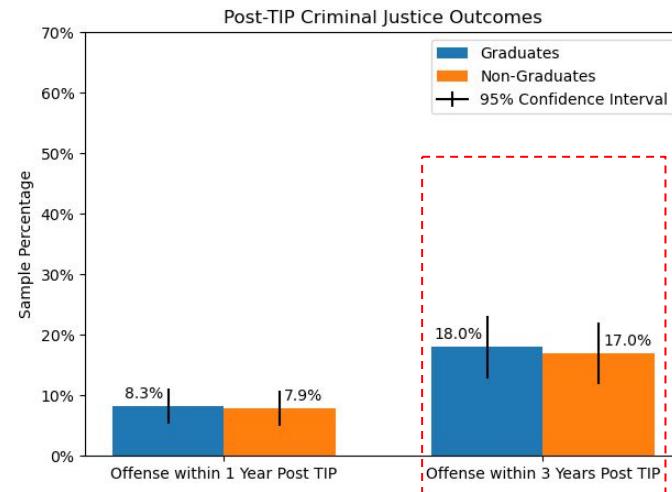
# Graphs/Tables from Midsemester

# Time Period Analysis - Offense Rates before/after TIP

## PRE-TIP



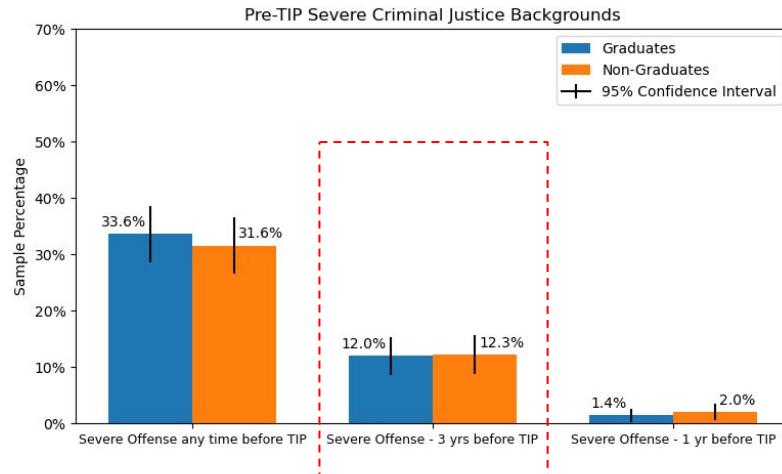
## POST-TIP



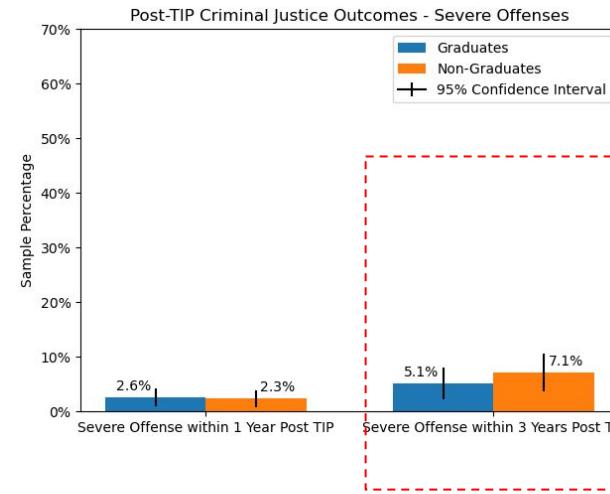
Comparing offense rates 3 years before TIP to 3 years after TIP, it seems  
**offense rates decline somewhat for both groups**

# Offense Rates for Severe Offenses (OGS 6+)

## PRE-TIP



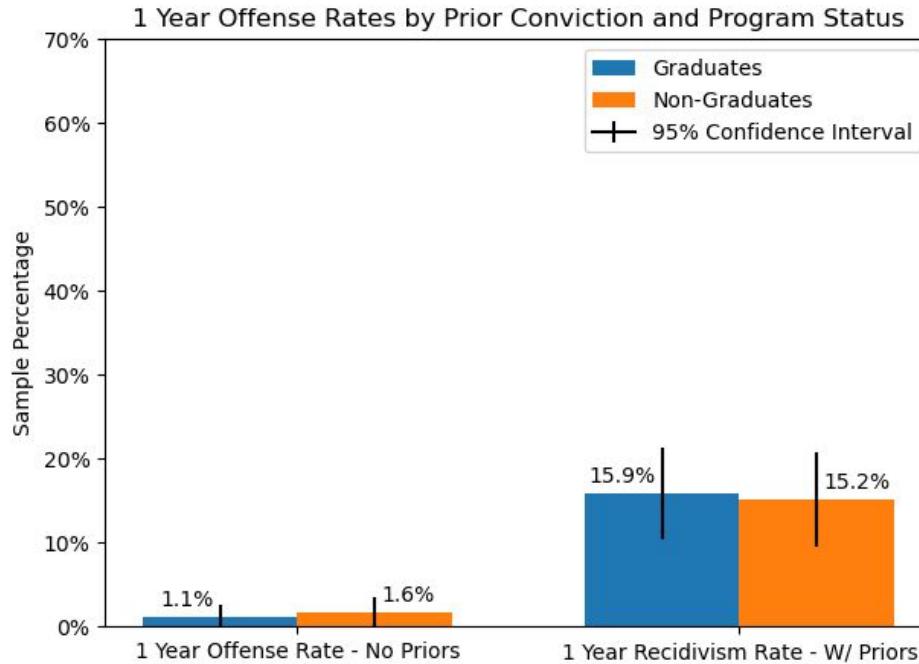
## POST-TIP



Similar but slightly accentuated pattern: 3 year severe offense rate for graduates is **2.5X smaller** after TIP

# 1-Year offense rates by Prior Conviction Status

- Those without prior convictions **less likely** to offend post TIP
- Groups are **statistically indistinguishable** from each other



# Logistic Regression: Model 2

- No strong evidence of **TIP graduation's** effect
- Being **older is associated with lower likelihood** of offending after TIP
  - 1-year increase in age is associated with **~9% lower** probability of severe offense
  - 10-year increase in age is associated with **~60% lower** likelihood of severe offense
- Having a **severe offense pre-TIP is associated with higher likelihood of severe offense** post-TIP:
  - **~3 times** higher odds of severely offending in 1 year after TIP

Outcome variable	Graduation (odds)	Age (odds)	Severe pre-TIP Offense (odds)
Severe Offense 1 year post-TIP	0.87	0.91*	3.43*
Severe Offense 3 years post-TIP	0.82	0.91*	2

\* Estimate is statistically significant at 95% confidence level (547 and 297 observations)