Criminal Justice Coordinating Council

Childhood Risk Factors that Increase the Likelihood of a Young Adult Homicide Conviction

Report

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Background

Given the rise in gun violence that the District has experienced in recent years, the Criminal Justice Coordinating Council (CJCC), in collaboration with the Office of Gun Violence Prevention, commissioned the National Institute of Criminal Justice Reform (NICJR) to generate a Gun Violence Reduction Strategic plan for the District of Columbia in 2022 (see: CJCC Releases "Gun Violence Reduction Strategic Plan"cjcc.dc.gov.) The strategic plan includes 16 recommendations across three categories: Prevention, Intervention and Community Transformation. One of the recommendations in the prevention category is to conduct an analysis of childhood risk factors for young adults (18 – 24) convicted of homicide or attempted homicide. The purpose of the analysis is to determine what were the risk factors for these young adults, so that the District can provide intensive services and supports for any youth who currently have those same risk factors, in hopes of preventing them from engaging in violence.

In 2023, the Criminal Justice Coordinating Council (CJCC) Information Sharing Emergency Amendment Act of 2023 (DC Act 25-74) was passed to require the CJCC to conduct an analysis of childhood risk factors that increase the likelihood of future involvement in gun violence. Per DC Act 25-74, and the recommendation from the "Gun Violence Reduction Strategic Plan," the current study used administrative data and a retrospective longitudinal design to assess childhood risk factors that may have increased the likelihood of being convicted of homicide or attempted homicide at ages 18-24. Specifically, the present study examined:

1. What childhood risk factors (e.g., economic, family, education, mental health, juvenile criminal history) were retrospectively present among young adults (18 – 24) convicted of homicide or attempted homicide;
2. How childhood risk factors were similar and/or different among homicide or attempted homicide group and comparison groups of young adults convicted of robbery and non-violent offenses; and
3. The extent to which the group of young adults convicted of homicide or attempted homicide were predicted by childhood risk factors.

The NICJR is conducting a companion qualitative study.

Summary of Key Findings

1. **Homicide/attempted homicide group vs. non-violent group**: A significantly higher proportion of young adults (ages 18 – 24 at the time of offense) convicted of homicide/attempted homicide were found to have 1) at-risk indicator, 2) internalizing disorder, 3) substance use disorder, and 4) juvenile arrests for violent offenses during their childhood/adolescent years compared to young adults convicted of non-violent offenses.
    a. A juvenile arrest for violent offenses was the only significant predictor of homicide/attempted homicide offenders at ages 18 -24 when these four risk factors were examined simultaneously.
    b. Specifically, having a juvenile violent arrest increased the odds of being in the homicide group by 2.27 times when compared to the non-violent group, controlling for other risk factors. The predictive power of the statistical model was close to the acceptable level.

2. **Homicide/attempted homicide group vs. robbery group**: The homicide/attempted homicide group and robbery group were found to share more similar characteristics on childhood risk factors than the non-violent group. However, significantly more individuals in the homicide/attempted homicide group had 1) substance use disorders and 2) juvenile arrests for weapon violations than in the robbery group before age 18.
    a. When substance use disorders and juvenile arrests for weapon violations were examined simultaneously in a statistical model, these two risk factors became marginally significant ($.05 < p < .10$) in predicting future homicide/attempted homicide offending. The predictive power of the statistical model was not acceptable.
3. The study findings highlight an avenue for future research on early intervention and/or prevention efforts especially with juveniles committing violent offenses.

Summary of Methodology and Limitations

Based on DC Superior Court data, the following study populations were intentionally pulled from disposed cases of young adults (ages 18 – 24 at the time of the offense) convicted of:

1. **Homicide** (1st Degree Murder, 2nd Degree Murder, Felony Murder, Voluntary Manslaughter, and/or Involuntary Manslaughter) or **attempted homicide** (Attempt with Intent to Kill, Aggravated Assault, Aggravated Assault While Armed, Assault with a Dangerous Weapon, and/or Assault with Significant Bodily Injury (Felony Assault)), as a main group;
2. **Robbery** (Robbery, Attempt to Commit Robbery, and/or Assault with Intent to Commit Robbery), as a comparison group; and
3. **Non-violent** (disorderly conduct, drug, or property) crimes, as a comparison group.

The homicide/attempted homicide group turned out to be all-male, and thus robbery and non-violent groups were restricted to all-male for analytical purposes. To ensure each group was as mutually exclusive and as distinct as possible, we further excluded those who had ever been arrested for homicide/attempted homicide during their young adult years (i.e., ages 18-24) from the robbery group, and those who had ever been arrested for homicide/attempted homicide and/or violent offenses during their young adult years from the non-violent group. This was done because we were interested in identifying risk factors that temporally precede the onset of homicide/attempted homicide during ages 18 - 24. In addition, we excluded those who did not have DC home addresses (see Appendix A).

We then obtained data from seven youth-serving agencies in the District to determine the extent to which particular risk factors were evident before age 18 for individuals in our sample. Specifically, we identified 21 risk factors based on the CJCC's root cause analysis (2020) and the existing literature (see Table 1).

Table 1. Descriptions of administrative data

Factor (Variable) in Childhood/Adolescence	Variable Type	Administrative Data Source
Economic Resources		
Ever experienced homelessness	Binary (0/1)	OSSE
Ever had Medicaid recipiency	Binary (0/1)	DHCF
Childhood Maltreatment		
Ever had removal to foster care	Binary (0/1)	CFSA
Ever had reported abuse	Binary (0/1)	CFSA
Ever had reported neglect	Binary (0/1)	CFSA
Educational Experiences		
Ever had any (in-school and/or out-of-school) suspensions	Binary (0/1)	OSSE
Ever had at-risk indicator	Binary (0/1)	OSSE DHS (TANF)[1]
Ever had an IEP in place	Binary (0/1)	OSSE
Mental, Behavioral, Developmental, and Substance Use Disorders		
Ever had externalizing disorders	Binary (0/1)	DHCF
Ever had internalizing disorders	Binary (0/1)	DHCF
Ever had comorbid disorders	Binary (0/1)	DHCF
Ever had developmental disorders	Binary (0/1)	DHCF
Ever had substance use disorders		
Juvenile Criminal History in DC: Arrest and Commitment		
Ever had any juvenile arrests	Binary (0/1)	MPD
Ever had juvenile arrests for weapon violations	Binary (0/1)	MPD
Ever had juvenile arrests for violent offenses (crime of violence)[2]	Binary (0/1)	MPD
Ever committed to DYRS	Binary (0/1)	DYRS
Family/Household Environment		
One or more parent ever incarcerated	Binary (0/1)	CFSA
One or more sibling(s) ever incarcerated	Binary (0/1)	CFSA
Ever experienced domestic violence	Binary (0/1)	CFSA
Ever been in mother-only (single-mother) household	Binary (0/1)	CFSA

While some agencies were able to provide historical data, the earliest date of available data differed by each agency (see Appendix A). Thus, we further limited our study population to youth born after 1996 to ensure that our administrative data captures their childhood and adolescent years (i.e., before age 18) to some extent. After all restrictions and exclusions discussed above applied, our study population consisted of 45 in the homicide/attempted homicide group, 57 in the robbery group, and 74 in the non-violent group, a total of 176 young male adults.

All administrative data were linked based on deterministic or probabilistic matching on basic demographic information. Descriptive and correlation analyses were conducted to provide basic information about variables in a dataset and to highlight potential relationships among the variables.

[1] See the section of economic resources in Appendix A.

[2] Crime of violence defined by the DC Statue (§ 23–1331). CJCC re-coded MPD data accordingly.

Chi-square tests were conducted to determine any differences in risk factors among the groups and make a purposeful variable selection for the subsequent statistical models. Multivariable logistic regression analyses were conducted to calculate the probability of becoming a homicide/attempted homicide offender using selected risk factors based on chi-square results. Then, the area under the curve (AUC) was calculated using the receiver operating characteristic (ROC) curve analysis to evaluate the predictive power of the statistical models (see Appendix A).

Several methodological and analytical limitations should be noted (see Appendix A):

- **External validity (generalizability)**: This study adopted a purposive sampling approach where we studied the populations whose characteristics were intentionally defined for the study purposes using inclusion and exclusion criteria (i.e., pulling homicide/attempted homicide, robbery, and non-violent groups). Therefore, external validity (generalizability) of the study findings would be limited.
- **Limitations of administrative data:** Although the use of administrative data in a retrospective analysis has several advantages over traditional retrospective studies that recruit participants, the use of administrative data in our study has several limitations: 1) administrative sources of information are likely to under-estimate actual incidence by focusing only on those cases that result in some sort of records in the system; and 2) not all contributing agencies were able to provide historical data (i.e., this study does not cover one's full childhood/adolescent years), and thus age or temporal effect could not be examined in this study.
- **Biological and cognitive factors**: As this study solely utilized administrative data, other biological or cognitive factors known to be relevant predictors of serious violence and homicide, such as brain mechanisms or decision-making processes,[3] could not be studied.
- **Sample size**: A small sample size is not atypical in homicide studies as homicide is considered to be a relatively rare occurrence. Further research is warranted with a larger sample size to increase the power of the tests and should be replicated in other longitudinal data sets that could be available.

[3] Ling, S., Umbach, R., & Raine, A. (2019). Biological explanations of criminal behavior. *Psychology, Crime & Law: PC & L, 25*(6), 626–640. https://doi.org/10.1080/1068316X.2019.1572753

Findings

Comparison of Demographics and Childhood Risk Factors among Homicide, Robbery, and Non-Violent Groups

Demographic Characteristics

After data was cleaned per the exclusion criteria (see Appendix A), a total of 176 young adults were examined in this study: 45 homicide/attempted homicide group (M_{age} = 19.89 years at the time of offense), 57 robbery group (M_{age} = 19.11 years at the time of offense), and 74 non-violent group (M_{age} = 19.72 years at the time of offense). Each group had similar proportions of Black males (about 97% on average) and most individuals in all three groups resided in Wards 7 or 8 (see Table 2).

Table 2. Characteristics of study groups

Demographic characteristic	Total (*N* = 176)	Homicide/attempted homicide group (*n* = 45)	Robbery group (*n* = 57)	Non-violent group (*n* = 74)
	M(SD) or %	M(SD) or %	M(SD) or %	M(SD) or %
$M_{age\ at\ offense}$[a]	19.56 (SD = 1.37)	19.89 (SD = 1.45)	19.11 (SD = 1.29)	19.72 (SD = 1.30)
Gender				
Male	100%	100%	100%	100%
Female	0%	0%	0%	0%
Race/Ethnicity				
Black	97.16%	97.78%	96.49%	97.30%
Hispanic	0.57%	0%	1.75%	0%
White	1.70%	2.22%	1.75%	1.35%
Unknown	0.57%	0%	0%	1.35%
Ward[b]				
Ward 1	7.95%	4.44%	10.53%	8.11%
Ward 2	3.41%	2.22%	1.75%	5.41%
Ward 3	1.14%	0%	1.75%	1.35%
Ward 4	9.09%	2.22%	7.02%	14.86%
Ward 5	14.77%	15.56%	10.53%	17.57%
Ward 6	13.64%	15.56%	12.28%	13.51%
Ward 7	35.23%	40.00%	36.84%	31.08%
Ward 8	46.02%	31.11%	52.63%	50.00%

Sources: DCSC and MPD data submission

[a] Mean age at the time of offense was calculated from the convicted cases between January 1, 2018 – July 31, 2022 (ages 18 – 24); [b] A person may have lived across multiple Wards.

Childhood Risk Factors

The study used chi-square analyses to compare three groups on the 21 childhood risk factors (see Table 1). Overall, there were no significant group differences (at $p < .05$) among the homicide/attempted homicide, robbery, and non-violent groups with respect to economic resources, childhood maltreatment, and family/household environment. For example, more than three-fourths were Medicaid recipients during their childhood/adolescent years: 86.67% of homicide/attempted homicide, 78.95% of robbery, and 77.03% of non-violent groups (see Table 3).

Homicide/attempted homicide group vs. non-violent group

A significantly higher ($p \leq .05$) proportion of the homicide/attempted homicide group were found to have the following four risk factors compared to the non-violent group during their childhood and adolescent years (see Table 3):

- **At-risk indicator**: More individuals in the homicide/attempted homicide group had an at-risk indicator[4] than in the non-violent group (94.87% vs. 83.61%; OR = 3.73, CI [0.98 – 14.14]).
- **Internalizing disorders**: More individuals in the homicide/attempted homicide group had an internalizing disorder[5] diagnosis than in the non-violent group (51.11% vs. 32.43%; OR = 2.18, CI [1.02 – 4.66]) .
- **Substance use disorders**: More individuals in the homicide/attempted homicide group had a substance use diagnosis than in the non-violent group (48.89% vs. 29.73%; OR = 2.26, CI [1.05 – 4.87]).
- **Juvenile arrests for violent offenses**: More individuals in the homicide/attempted homicide group had a juvenile arrest for violent[6] offenses than in the non-violent group (48.89% vs. 25.68%; OR = 2.77, CI [1.27 – 6.06]).

Homicide/attempted homicide group vs. robbery group

The homicide/attempted homicide group and robbery group were found to share more similar characteristics in childhood and adolescence than the non-violent group. Specifically, similar proportions of the homicide/attempted homicide group and the robbery group had risk factors associated with economic hardship, childhood maltreatment, educational experiences, mental, behavioral, and developmental disorders, and family/household environment retrospectively (see Table 3).

[4] "At-risk indicator" represents a student who is identified as one or more of the following: (1) experiencing homelessness; (2) had involvement with the Child and Family Services Agency (CFSA); (3) qualifies for the Temporary Assistance for Needy Families (TANF) program or the Supplemental Nutrition Assistance Program (SNAP); or (4) a high school student that is "overage," or one year older, or more, than the expected age for the grade in which the student is enrolled.

[5] Internalizing disorders include depressive episode, recurrent depressive disorder, recurrent/persistent or unspecified mood disorder, bipolar disorder, neurotic disorder, general anxiety disorder, reaction to stress, adjustment reaction, and emotional disorders.

[6] Crime of violence defined by DC Code § 23–1331.

However, the homicide/attempted homicide group significantly differed from the robbery group ($p < .05$) on the following two risk factors during their childhood and adolescent years:

- **Substance use disorders**: More individuals in the homicide/attempted homicide group had a substance use diagnosis than in the robbery group (48.89% vs. 28.07%; OR = 2.45, CI [1.08 – 5.58]).
- **Juvenile arrests for weapon violations**: More individuals in the homicide/attempted homicide group had a juvenile arrest for weapon violations than in the robbery group (33.33% vs. 15.79%; OR = 2.67, CI [1.04 – 6.85]).

Table 3. Descriptive statistics (retrospective percentages), chi-square p-value significance, and odds ratio (OR) with 95% confidence interval (CI).

Childhood/Adolescence Factor (Variable)	Non-Violent (n = 74)	Robbery (n = 57)	Homicide/ Attempted Homicide (n = 45)	Non-Violent[a] vs. Robbery		Robbery[a] vs. Homicide/Attempted Homicide		Non-Violent[a] vs. Homicide/Attempted Homicide	
Ever had…	%	%	%	χ2 p-value significance	Odds Ratio [95% CI]	χ2 p-value significance	Odds Ratio [95% CI]	χ2 p-value significance	Odds Ratio [95% CI]
Economic Resources									
Experienced homelessness	27.87	29.17	23.08	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Medicaid recipiency	77.03	78.95	86.67	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Childhood Maltreatment									
Removal to foster care	16.22	17.54	8.89	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Reported abuse	4.05	8.77	2.22	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Reported neglect	12.16	22.81	17.78	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Educational Experiences[7]									
Any school suspensions	47.30	49.12	60.00	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
At-risk indicator	83.61	97.96	94.87	$p < .05$	8.95 [1.33 – 60.35]	n.s.	n.s.	**$p = .05$**	**3.73 [0.98 – 14.14]**
IEP	39.34	56.25	51.28	$p = .08$	n.s.	n.s.	n.s.	n.s.	n.s.
Mental, Behavioral, Developmental, and Substance-Use Disorders									
Externalizing disorders	22.97	43.86	37.78	$p < .05$	2.62 [1.23 – 5.56]	n.s.	n.s.	$p = .08$	n.s.
Internalizing disorders	32.43	52.63	51.11	$p < .05$	2.31 [1.14 – 4.72]	n.s.	n.s.	**$p < .05$**	**2.18 [1.02 – 4.66]**
Comorbid disorders	18.92	40.35	31.11	$p < .01$	2.90 [1.32 – 6.37]	n.s.	n.s.	n.s.	n.s.
Developmental disorders	6.76	8.77	8.89	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Substance use disorders	29.73	28.07	48.89	n.s.	n.s.	**$p < .05$**	**2.45 [1.08 – 5.58]**	**$p < .05$**	**2.26 [1.05 – 4.87]**
Juvenile Criminal History in DC: Arrest and Commitment									
Any juvenile arrests	60.81	68.42	75.56	n.s.	n.s.	n.s.	n.s.	$p = .10$	n.s.
Juvenile arrests for weapon violations	21.62	15.79	33.33	n.s.	n.s.	**$p < .05$**	**2.67 [1.04 – 6.85]**	n.s.	n.s.
Juvenile arrests for violent offenses	25.68	43.86	48.89	$p < .05$	2.26 [1.08 – 4.73]	n.s.	n.s.	**$p < .05$**	**2.77 [1.27 – 6.06]**
Ever committed to DYRS	13.51	33.33	26.67	$p < .01$	3.20 [1.35 – 7.60]	n.s.	n.s.	$p = .07$	n.s.
Family/Household Environment									
One or more parent ever incarcerated	2.70	1.75	2.22	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
One or more sibling(s) ever incarcerated	2.70	1.75	2.22	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Ever experienced domestic violence	1.35	3.51	0.00	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Mother-only (single-mother) household	10.81	14.04	8.89	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Sources: CFSA, DCSC, DHCF, DHS, DYRS, MPD, and OSSE data submission; [a] Reference group (0)

[7] See "Missing Data" in Appendix A

The Prediction of Young Adults Convicted of Homicide/Attempted Homicide

Multivariable logistic regression analyses were conducted to examine childhood risk factors that increase the likelihood of future involvement in homicide/attempted homicide crimes at ages 18 – 24. Following the chi-square analyses (see Table 3), significant risk factors ($p \leq .05$) were further explored in the subsequent multivariable logistic regression analyses.

Homicide/attempted homicide group vs. non-violent group

As shown in Table 4, an at-risk indicator, internalizing disorders, substance use disorders, and juvenile arrest charges for violent offenses were entered into the multivariable logistic regression model to identify the best predictor(s) for the group of young adults convicted of homicide/attempted homicide compared to the non-violent group. Of the four risk factors, a juvenile arrest charge for violent offense(s) was the only significant predictor of homicide/attempted homicide offenders at ages 18 – 24 when these four risk factors were examined simultaneously.

Specifically, being arrested for violent offenses as a juvenile increased the odds of being in the homicide/attempted homicide group at ages 18 – 24 by 2.27 times when compared to the non-violent group (OR = 2.27, $p < .05$, CI [1.01 – 5.11]), controlling for all other risk factors in the model (see Table B.6. in Appendix B)

Table 4. Multivariable logistic regression analysis predicting homicide/attempted homicide group (vs. non-violent group)

Group Homicide/attempted homicide (1) vs. Non-violent (0)	Odds ratio	*p*-value	95% conf. interval
At-risk indicator	2.56	n.s.	[0.65 – 10.06]
Internalizing disorders	1.56	n.s.	[0.67 – 3.64]
Substance use disorders	1.61	n.s.	[0.68 – 3.79]
Juvenile arrests for violent offenses	**2.27***	***p* < .05**	**[1.01 – 5.11]**

Sources: DCSC, DHCF, DHS, MPD, and OSSE data submission
*$p < .05$

Using the receiver operating characteristic curve (ROC), the area under the curve (AUC) of the above statistical model was examined to evaluate the predictive power of the model, i.e., how well the statistical model can discriminate groups correctly. The discriminating capability of the model was close to the acceptable value (0.7), with the AUC = 0.6958. However, this number should be interpreted with caution as a juvenile violent arrest was the only significant factor in the model and thus further research with a larger sample size is warranted (see Figure B.1. in Appendix B).

Homicide/attempted homicide group vs. robbery group

As chi-square analyses revealed that the homicide/attempted homicide group and robbery group significantly differed on the proportions of substance use disorders and juvenile arrests for weapon

violations, these two risk factors were entered into a multivariable logistic regression model to examine the simultaneous effect of multiple factors in predicting the group of young adults convicted of homicide/attempted homicide compared to the robbery group.

The logistic regression results showed that the logistic regression model was significant ($p < .05$); however, the effects of substance use disorders and the juvenile weapon arrest history were marginally significant ($.05 < p < .01$) when these factors were examined all at once (see Table 5 and Table B.7. in Appendix B). The AUC value (0.6404) showed that the predictive power of this statistical model was not acceptable.

Table 5. Multivariable logistic regression analysis predicting homicide/attempted homicide group (vs. robbery group)

Group Homicide/attempted homicide (1) vs. Robbery (0)	Odds ratio	*p*-value	95% conf. interval
Substance use disorders	2.25†	$p = .06$	[0.97 – 5.21]
Juvenile arrests for weapon offenses	2.41†	$p = .07$	[0.92 – 6.33]

Sources: DCSC, DHCF, and MPD data submission
†$p < .10$

Conclusion

Our findings suggest that homicide/attempted homicide offending at ages 18 – 24 may be preceded by a history of juvenile violent offenses and weapon violations, internalizing disorders, substance use disorders, and at-risk indicators during childhood/adolescence, to some extent. Of these risk factors, a juvenile violent offense was found to be the strongest predictor of young adults convicted of homicide/attempted homicide when compared to the non-violent group. A history of juvenile arrest for weapon violations and substance use disorders were the only childhood risk factors that could potentially distinguish the homicide/attempted homicide group from the robbery group. These results are in line with previous literature suggesting that a violent criminal history and situational factors (e.g., carrying a weapon and having used alcohol) increase the likelihood of committing future lethal violence including murder.[8,9,10] We should note, however, that our findings do not mean that all children who have these risk factors will become homicide offenders. A causal conclusion cannot be made from this study.

[8] Farrington, D. P., Loeber, R., & Berg, M. T. (2012). Young men who kill: A prospective longitudinal examination from childhood. *Homicide Studies: An Interdisciplinary & International Journal, 16*(2), 99–128. https://doi.org/10.1177/1088767912439398

[9] Phillips, S., Matusko, J., & Tomasovic, E. (2007). Reconsidering the relationship between alcohol and lethal violence. *Journal of interpersonal violence, 22*(1), 66–84. https://doi.org/10.1177/0886260506294997

[10] Ganpat, S. M., Liem, M., van der Leun, J., & Nieuwbeerta, P. (2014). The influence of criminal history on the likelihood of committing lethal versus nonlethal violence. *Homicide Studies: An Interdisciplinary & International Journal, 18*(2), 221–240. https://doi.org/10.1177/1088767912466082

The study findings call for attention to early intervention and/or prevention efforts especially with juveniles committing violent offenses,[11] e.g., developing targeted, intensive, and appropriate programs or services tailored to reducing the risk of committing homicide (or other violent offenses) at a later phase in life. Consistent with the existing literature,[12] juvenile violent offenses appear to be associated with other risk factors in multiple domains in our overall sample (e.g., positively correlated with experienced homelessness, reported neglect, school suspensions, internalizing disorders, and any juvenile arrests and weapon violations; see Table B.2.). Thus, early intervention and/or prevention efforts and strategies that target juvenile violent offenders and their risk factors would be an avenue for future research.

[11] Welner, M., DeLisi, M., Knous-Westfall, H.M. et al. (2023). Homicide and criminal maturity of juvenile offenders: A critical review. *American Journal of Criminal Justice, 48*, 1157–1182. https://doi.org/10.1007/s12103-022-09694-5

[12] Loeber, R., Pardini, D., Homish, D. L., Wei, E. H., Crawford, A. M., Farrington, D. P., Stouthamer-Loeber, M., Creemers, J., Koehler, S. A., & Rosenfeld, R. (2005). The prediction of violence and homicide in young men. *Journal of consulting and clinical psychology, 73*(6), 1074–1088. https://doi.org/10.1037/0022-006X.73.6.1074

Appendix A. Methodology

Study Populations

The CJCC requested data from the DC Superior Court (DCSC) to obtain information on young adults, ages 18-24 at the time of the offense,[13] convicted of homicide/attempted homicide, other violent crimes, and nonviolent crimes between January 1, 2018 – July 31, 2022, in the District. Based on their sentenced charges, three groups were formed as seen in Table A.1.

Table A.1. Groups and Sentenced Charges

Groups		Sentenced Charges
Group 1: Main Group	Homicide	1st Degree Murder; 2nd Degree Murder; Felony Murder; Voluntary Manslaughter; and Involuntary Manslaughter
	Attempted Homicide	AWIK; Aggravated Assault; Aggravated Assault While Armed; Assault with a Dangerous Weapon; and Assault with Significant Bodily Injury (Felony Assault)
Group 2: Comparison Group	Robbery	Robbery; Attempt to Commit Robbery; and Assault W/I to Commit Robbery[14]
Group 3: Comparison Group	Nonviolent	Disorderly Conduct; Drug; and Property Offense[15]

Note. All charges were based on D.C. Codes, e.g., § 22-401, § 22-402, § 22–2801, § 22–2802, § 22–2803, § 48–904, § 22–3211, § 22–1321, § 22–3232, § 22–303, etc.

Exclusion Criteria

The following exclusion criteria were used to define the study groups:

1. The homicide/attempted homicide group turned out to be all-male, and thus comparison groups were restricted to all-male (i.e., females were excluded).[16]
2. As the current study focuses on identifying risk factors that temporally precede the commission of homicide/attempted homicide during ages 18-24, we ensured that each group was as mutually exclusive and as distinct as possible. Specifically, we further excluded those who had ever been arrested for homicide/attempted homicide during their young adult years (i.e., ages 18 – 24) from the robbery group, and those who had ever been arrested for homicide/attempted homicide and/or violent offenses during their young adult years from the non-violent group.
3. Because the earliest date for which data can be retrieved differed by agency (e.g., OSSE data starting SY13-14, MPD data starting CY13, etc.), the study population was further limited to persons born after 1996 to ensure that our administrative data captures their

[13] The prosecution phase offense date was used.
[14] Including carjacking.
[15] 8% of disorderly conduct; 47% of drug; and 45% of property offense.
[16] The current study was not possible to examine gender effects or differences as the main study group did not have any females.

childhood/adolescent years (i.e., before age 18) to some extent, i.e., those who were born before 1996 were excluded.[17]

4. Those who did not have any DC addresses during their childhood/adolescent years were excluded.[18]

Homicide/Attempted Homicide Group

According to DC Superior Court, there were 145 disposed cases of young adults (ages 18-24 at the time of the offense) charged and/or convicted of homicide/attempted homicide between January 1, 2018 – July 31, 2022. These 145 disposed court cases were associated with 88 young adults who all turned out to be male. Their sentenced charges for 1) homicide included "1st Degree Murder, 2nd Degree Murder, Felony Murder, Voluntary Manslaughter, and Involuntary Manslaughter"; and 2) attempted homicide included "Attempted With Intent to Kill, Aggravated Assault, Aggravated Assault While Armed, Assault with a Dangerous Weapon, and Assault with Significant Bodily Injury (Felony Assault)." After data was cleaned per the exclusion criteria, **45 young male adults** convicted of homicide/attempted homicide were included in the main study group (M_{age} = 19.89 years at the time of the homicide/attempted homicide offenses).

Robbery Group

According to DC Superior Court, there were 165 disposed cases of young adults (ages 18-24 at the time of the offense) charged and/or convicted of robbery, attempt to commit robbery, and/or assault with intent to commit robbery between January 1, 2018 – July 31, 2022. The 165 disposed cases were associated with 147 young male adults. After applying the exclusion criteria, **57 young male adults** convicted of robbery offenses were examined as a comparison group (M_{age} = 19.11 years at the time of the robbery offenses).

Non-violent Group

In this study, we operationally define non-violent crimes as "property, drug, and public order offenses which do not involve a threat of harm or an actual attack upon a victim (e.g., Durose & Mumola, 2004)."[19] According to DC Superior Court, there were 641 disposed cases of young adults (ages 18-24 at the time of the offense) charged and/or convicted of disorderly conduct, drug, and property offenses between January 1, 2018 – July 31, 2022. The 641 disposed cases were associated with 386 young male adults. Due to restricted availability of administrative data across multiple agencies (e.g., data only goes back to 2013), males who were born after 1996 were pulled, resulting in 165 young adults convicted of disorderly conduct only, drug only, or property crime only between January 1, 2018 – July 31, 2022. After data was cleaned per the exclusion criteria, **74 young male adults** convicted of non-violent crimes were examined as the other comparison group (M_{age} = 19.72 years at the time of the non-violent offenses).

[17] In our final sample, a birth year ranged from 1996 to 2003.

[18] After the exclusion criteria 1-3 were applied, about 6% of the young male adults were additionally excluded because they did not have any DC addresses during their childhood/adolescent years.

[19] https://bjs.ojp.gov/content/pub/pdf/pnoesp.pdf

Data Collection and Procedure

The administrative datasets were provided by the following partnering District agencies:

- District of Columbia Superior Court (DCSC) Criminal Division
    - Cases of young adults (ages 18-24 at the time of offense) convicted of homicide/attempted homicide, robbery, and non-violent (disorderly conduct, drug, and property offense) crimes (per D.C. Codes) between January 1, 2018 – July 31, 2022
- District of Columbia Metropolitan Police Department (MPD)
    - Juvenile and adult arrest data starting CY2013
- Department of Youth Rehabilitation Services of the District of Columbia (DYRS)
    - Juvenile commitment to DYRS (Historical data)
- Office of the State Superintendent of Education (OSSE)
    - Childhood educational experiences starting SY2013-2014
- District of Columbia Department of Human Services (DHS)
    - Temporary Assistance for Needy Families (TANF) recipiency during childhood starting CY2017
- District of Columbia Childhood and Family Services Agency (CFSA)
    - Childhood maltreatment data (Historical data)
- District of Columbia Department of Health Care Finance (DHCF)
    - Medicaid data (enrollment and claims data) on mental, behavioral, developmental, and substance use disorders starting FY2010

After the CJCC received DCSC data on young adults (ages 18-24 at the time of the offense) convicted of homicide/attempted homicide, robbery, and nonviolent crimes between January 1, 2018 – July 31, 2022, in Washington D.C., the CJCC applied the exclusion criteria to form study groups (see "Study Populations"). Then, the CJCC provided each agency sufficient personally identifiable information (PII), such as full name, date of birth, gender, race/ethnicity, Police Department Identification number (PDID), X-references number, and/or home addresses, to allow matching individuals across systems and providing the information of interest in return. All relevant report dates and/or enrollment/eligibility dates were requested as well.

Data and Measures

The current study was based on risk factors known from the CJCC's root cause analysis (2020) and the existing literature. These childhood risk factors that were presented before age 18 (i.e., childhood to adolescence) represent the following domains: economic resources, childhood maltreatment, educational experience, mental, behavioral, developmental, and substance use disorders, juvenile arrest and commitment history, and family/household environment. Table A.2. shows the list of childhood/adolescence factors, administrative data variables and values, and their sources.

Table A.2. Descriptions of administrative data

Factor (Variable) in Childhood/Adolescence	Variable Type (Coding)	Administrative Data Source
Economic Resources		
Ever experienced homelessness	Binary (0 = No; 1 = Yes)	OSSE
Ever had Medicaid recipiency	Binary (0 = No; 1 = Yes)	DHCF
Childhood Maltreatment		
Ever had removal to foster care	Binary (0 = No; 1 = Yes)	CFSA
Ever had reported abuse	Binary (0 = No; 1 = Yes)	CFSA
Ever had reported neglect	Binary (0 = No; 1 = Yes)	CFSA
Educational Experiences		
Ever had any (in-school and/or out-of-school) suspensions	Binary (0 = No; 1 = Yes)	OSSE
Ever had at-risk indicator	Binary (0 = No; 1 = Yes)	OSSE DHS (TANF)[20]
Ever had an IEP in place	Binary (0 = No; 1 = Yes)	OSSE
Mental, Behavioral, Developmental, and Substance Use Disorders		
Ever had externalizing disorders	Binary (0 = No; 1 = Yes)	DHCF
Ever had internalizing disorders	Binary (0 = No; 1 = Yes)	DHCF
Ever had comorbid disorders	Binary (0 = No; 1 = Yes)	DHCF
Ever had developmental disorders	Binary (0 = No; 1 = Yes)	DHCF
Ever had substance use disorders	Binary (0 = No; 1 = Yes)	DHCF
Juvenile Criminal History in DC: Arrest and Commitment		
Ever had any juvenile arrests	Binary (0 = No; 1 = Yes)	MPD
Ever had juvenile arrests for weapon violations	Binary (0 = No; 1 = Yes)	MPD
Ever had juvenile arrests for violent offenses (crime of violence)[21]	Binary (0 = No; 1 = Yes)	MPD
Ever committed to DYRS	Binary (0 = No; 1 = Yes)	DYRS
Family/Household Environment		
One or more parent ever incarcerated	Binary (0 = No; 1 = Yes)	CFSA
One or more sibling(s) ever incarcerated	Binary (0 = No; 1 = Yes)	CFSA
Ever experienced domestic violence	Binary (0 = No; 1 = Yes)	CFSA
Ever been in mother-only (single-mother) household	Binary (0 = No; 1 = Yes)	CFSA

All administrative data values were re-coded to a binary variable (0/1) with 1 indicating that an individual ever had a risk factor during his childhood and adolescent years.

[20] See the section of economic resources.

[21] Crime of violence defined by the DC Statue (§ 23–1331). CJCC re-coded MPD data accordingly.

Economic resources

Economic resources were examined using the following data: 1) whether a person was ever reported as experiencing homelessness (OSSE data starting SY13-14); and 2) whether a person was ever enrolled in Medicaid (DHCF data staring FY10) at any time before age 18.

DHS provided the District's Temporary Assistance for Needy Families (TANF) data that goes back to 2017. Unfortunately, the data starting 2017 was not old enough to track most of our study sample's childhood or adolescent years. Therefore, TANF recipiency could not be measured as a single variable in this study. However, because OSSE's at-risk indicator captured TANF recipiency, the TANF data provided by DHS was used as supplemental data to cross-check OSSE's at-risk indicator data field. Those who were flagged as a TANF recipient during their childhood/adolescent years in DHS data were also found to have an at-risk indicator in OSSE data.

Childhood maltreatment

We obtained childhood maltreatment information from CFSA on whether a person ever had reported histories of removal from home to foster care (i.e., out-of-home placement), abuse, and/or neglect. An individual was coded a "1" if an outcome of a CFSA referral was a person being removed from home to foster care or if a person ever had a substantiated or inconclusive finding, or family assessment abuse or neglect matter on record with CFSA under age 18.

Educational experiences

Educational experiences were measured based on whether a person ever had in-school and/or out-of-school suspensions, at-risk indicator, or Individualized Education Program (IEP) in OSSE data starting SY13-14. The CJCC re-coded the counts of in-school and out-of-school suspensions into a binary value (0/1) to measure if a person ever had any school suspensions during his childhood and adolescent years. A person was coded a "1" if he ever had an IEP in place at any time before age 18.

At-risk indicator represents a student who is identified as one or more of the following:

- Experiencing homelessness;
- Had involvement with the Child and Family Services Agency (CFSA);
- Qualifies for the Temporary Assistance for Needy Families (TANF) program or the Supplemental Nutrition Assistance Program (SNAP); or
- A high school student that is "overage," or one year older, or more, than the expected age for the grade in which the student is enrolled.

CFSA, TANF, and SNAP data were provided to OSSE through a data sharing agreement with partnering city agencies. Overage was determined by the enrolled grade and date of birth provided by local educational agencies (LEAs). There was no available at-risk indicator for SY13-14 and therefore all observations for this variable were listed as "N/A" in the dataset. These N/A values were handled using multiple imputation in analyses (see "Missing Data").

Mental, behavioral, developmental, and substance use disorders

We obtained Medicaid claims data (starting FY2010) from DHCF where there was mental, behavioral, developmental, or substance abuse treatment. The data included all International Classification of Diseases (ICD) diagnoses codes associated with each claim. It should be noted that the data does not allow us to identify medical diagnoses of a person who received treatment under private insurance or treatment that was not billed to Medicaid, nor does it allow us to identify a person with undiagnosed mental health or substance abuse disorders. Therefore, the data likely underestimates the prevalence and effects of mental health and substance use disorders in the study population.

In line with the psychology and criminology research literature, we included the following disorder categories/domains: internalizing disorders, externalizing disorders, internalizing-externalizing comorbidity, developmental disorders, and substance use disorders. We initially included psychotic disorders (e.g., schizotypal disorders, schizoaffective disorders, other/unspecified non-organic psychotic disorder), however, psychotic related diagnosis was not found in our final analysis sample after matching and cleaning data per the sample exclusion criteria (see "Study Population").

Externalizing disorders included attention-deficit/hyperactivity disorder, conduct disorder, impulse disorder, and oppositional defiant disorder. Diagnosis codes in Medicaid claims data were re-coded per ICD-9: 312, 312.89, 313.81, 314.01; and ICD-10: F63, F90, F91, F91.3.

Internalizing disorders[22] included depressive episode, recurrent depressive disorder, recurrent/persistent or unspecified mood disorder, bipolar disorder, neurotic disorder, general anxiety disorder, reaction to stress, adjustment reaction, and emotional disorders; Diagnosis codes in Medicaid claims data were re-coded per ICD-9: 296, 296.2, 296.3, 296.8, 296.9, 300, 308, 309, 311, 313; and ICD-10: F31, F32, F33, F34, F38, F39, F40, F41, F42, F43, F48, F92, F93.

Individuals were coded as having internalizing-externalizing comorbidity (comorbid) "1" if they had both internalizing and externalizing disorders. Developmental disorders were coded based on ICD-10: F80 – F89. Substance use disorders (alcohol-related and substance use-related) were coded based on diagnosis codes per ICD-9[23] and ICD-10: F10 – F19.

Juvenile criminal history in DC: arrest and commitment

We examined whether a person had any 1) juvenile arrests; 2) juvenile arrests for weapon violations; and 3) juvenile arrests for violent offenses using MPD arrest data starting CY2013. In this study, we re-coded MPD charges per the definition of crime of violence in DC Code § 23–1331. The MPD arrest data includes juvenile arrests in DC only.

We obtained commitment information from DYRS. Individuals were coded a "1" if they ever committed to DYRS. DYRS also provided the top committed offense charges where 27% of them were violent offenses, 27% of them were other offenses (e.g., disorderly conduct, simple assault, sex offense, threat, and unlawful entry), 22% of them were property offenses, 17% of them were weapon offenses, and 7% of them were drug offenses in the total study sample. Although only the top committed offenses were

[22] Wu, X. Y., Kirk, S. F. L., Ohinmaa, A., & Veugelers, P. J. (2017). The importance of health behaviours in childhood for the development of internalizing disorders during adolescence. *BMC psychology, 5*(1), 38. https://doi.org/10.1186/s40359-017-0208-x

[23] https://www.ncbi.nlm.nih.gov/books/NBK310986/table/sb191.t4/

provided for this study, it is important to note that there may have been additional commitment charges associated with individuals in the study sample.

Juvenile adjudication information was not included in the current study due to data unavailability at the time of analyses.

Family or household environment

Family or household environment obtained from CFSA data measures whether 1) one or more parent was ever incarcerated; 2) one or more sibling(s) was ever incarcerated; 3) a person ever experienced domestic violence; and 4) a person had ever been in mother-only (single-mother) household during childhood and adolescence. As these variables were based on CFSA data, we should note that the numbers provided in this report likely show underestimated prevalence of the family or household environment variables in the study population (e.g., cases that were not reported).

Data Analytic Plan

Statistical analyses were conducted using STATA/BE 17.0 and SPSS 27. Descriptive analyses were conducted to provide descriptive information of the study sample and variables. Correlations (phi coefficients) were run to examine potential relationships among the study variables. Chi-square tests were conducted to examine 1) if there are any group differences in risk factors in childhood/adolescence; and 2) select the most relevant (candidate) risk factors ($p \leq .05$) to build parsimonious statistical models in the subsequent analyses. Following the chi-square analyses, significant risk factors ($p \leq .05$) were included in the subsequent multivariable logistic regression models to examine which risk factors increased the likelihood of being in the homicide/attempted homicide group, robbery group, or non-violent group. Odds ratios (OR) were reported to determine significant risk factors (e.g., OR > 1 exposure associated with higher odds of outcome) and compare the magnitude of various risk factors. The 95% confidence interval (CI) was reported to estimate the precision of the OR such that a large CI indicates a low level of precision of the OR, whereas a small CI indicates a higher precision of the OR. If the 95% confidence interval for the odds ratio includes 1, it indicates that the results are not statistically significant. Following the logistic regression analyses, the area under the curve (AUC) was calculated using the receiver operating characteristic (ROC) curve analysis to evaluate the predictive power of the statistical models. An AUC of 1 is a perfect model and an AUC of 0.5 is a random model or a model with no predictive value. We used *lroc* command in STATA to draw the ROC curve for the models.

Missing Data

OSSE provided data (starting in SY2013 – 2014) on the number of unexcused and excused absences. However, these variables were not included in our analyses due to several methodological/analytical limitations. For instance, the earliest available data (i.e., SY2013 – 2014) did not capture one's certain grades (as individuals were born in different years ranging from 1996 to 2003), a person was not

enrolled in Local Education Agencies (LEA) during a certain year, or a person was in DYRS, which resulted in 43% - 66% of N/A or missing (unknown) values across Grade 9 – 12 through the data matching and cleaning processes. Therefore, the number of unexcused and excused absences was excluded from the analyses (as one's record that was not found in OSSE data does not necessarily mean that their numbers of absences are zero).

There were about 15% of N/A values in an at-risk indicator in OSSE data in our final sample because there was no available at-risk indicator for SY2013-2014. Little's MCAR test showed that data was completely missing at random ($p > .05$). Therefore, we used multiple imputation to account for these N/A data in regression analyses.

Ethical Approval

This study was approved by the Institutional Review Board of the University of Southern Maine (IRB-2023-68).

Limitations

Several methodological and analytical limitations should be noted:

- **External validity (generalizability)**: This study adopted a purposive sampling approach where we studied the populations whose characteristics are of specific interest or defined for study purposes (i.e., pulling homicide/attempted homicide, robbery, and non-violent groups). As a result, we applied the number of inclusion and exclusion sample selection criteria set and made the subpopulations homogeneous within each group. Therefore, external validity of the study findings would be limited by the restrictions defined by the purposive nature of the study groups (e.g., generalization is possible only to the population from which the subpopulation was drawn; the findings cannot be generalized to offenders/defendants in everyday practice or female offenders/defendants).
- **Limitations of administrative data:** The use of administrative data in a retrospective analysis has several advantages over traditional retrospective studies that recruit participants, such that it 1) increases statistical power and allows population level analyses; 2) greatly reduces cost per subject for studies and risk modeling; 3) provides the ability to consider clinical and demographic subgroups in a single study; 4) enables the study of marginal populations who are difficult to recruit or address multi-system involved youth; and 5) no reliance on retrospective recall of adverse experiences.[24] However, the use of administrative data in our study also has several limitations: 1) administrative sources of information are likely to under-estimate actual incidence by focusing only on those cases that result in some sort of record in the system; and 2) not all contributing agencies were able to provide historical data (i.e., this study does not cover

[24] Lucenko, B. A., Sharkova, I. V., Huber, A., Jemelka, R., & Mancuso, D. (2015). Childhood adversity and behavioral health outcomes for youth: An investigation using state administrative data. *Child Abuse & Neglect, 47*, 48–58. https://doi.org/10.1016/j.chiabu.2015.07.006

one's full childhood/adolescent years), and thus age or temporal effect could not be examined in this study.

- **Biological and cognitive factors**: As this study utilized solely administrative data, other biological or cognitive factors known to be relevant predictors of serious violence and homicide, such as brain mechanisms or decision-making processes,[25] could not be studied.
- **Sample size**: A small sample size is not atypical in homicide studies,[26] as homicide is considered to be a relatively rare occurrence. However, further research is warranted with a larger sample size to increase the power of the tests and should be replicated in other longitudinal data sets that could be available. For instance, a longitudinal prospective investigation that follows individuals from childhood to early adulthood might be beneficial.[27]

[25] Ling, S., Umbach, R., & Raine, A. (2019). Biological explanations of criminal behavior. *Psychology, Crime & Law: PC & L, 25*(6), 626–640. https://doi.org/10.1080/1068316X.2019.1572753

[26] Ganpat, S. M., Liem, M., van der Leun, J., & Nieuwbeerta, P. (2014). The influence of criminal history on the likelihood of committing lethal versus nonlethal violence. *Homicide Studies: An Interdisciplinary & International Journal, 18*(2), 221–240. https://doi.org/10.1177/1088767912466082

[27] E.g., Pittsburgh Youth Study

Appendix B. Analyses

Demographic Characteristics

Table B.1. Characteristics of study groups

Demographic characteristic	Total (*N* = 176)	Homicide/attempted homicide group (*n* = 45)	Robbery group (*n* = 57)	Non-violent group (*n* = 74)
	M(SD) or %	M(SD) or %	M(SD) or %	M(SD) or %
$M_{age\ at\ offense}$[a]	19.56 (SD = 1.37)	19.89 (SD = 1.45)	19.11 (SD = 1.29)	19.72 (SD = 1.30)
Gender				
Male	100%	100%	100%	100%
Female	0%	0%	0%	0%
Race/Ethnicity				
Black	97.16%	97.78%	96.49%	97.30%
Hispanic	0.57%	0%	1.75%	0%
White	1.70%	2.22%	1.75%	1.35%
Unknown	0.57%	0%	0%	1.35%
Ward[b]				
Ward 1	7.95%	4.44%	10.53%	8.11%
Ward 2	3.41%	2.22%	1.75%	5.41%
Ward 3	1.14%	0%	1.75%	1.35%
Ward 4	9.09%	2.22%	7.02%	14.86%
Ward 5	14.77%	15.56%	10.53%	17.57%
Ward 6	13.64%	15.56%	12.28%	13.51%
Ward 7	35.23%	40.00%	36.84%	31.08%
Ward 8	46.02%	31.11%	52.63%	50.00%

Sources: DCSC and MPD data submission

[a] Mean age at the time of offense was calculated from the convicted cases between January 1, 2018 – July 31, 2022 (ages 18 – 24); [b] A person may have lived across multiple Wards.

Descriptive Statistics and Correlations (Phi Coefficients)

Table B.2. Descriptive statistics and correlations (phi coefficients) among study variables for the total study sample (*N* = 176)

	EH	MR	RFC	ABUSE	NEG	SUSP	ATRISK	IEP	EXT	INT	COM	DEV	SUB	JUARR	JUWARR	JUVARR	COMIT	PIC	SIC	DV	SM
EH	-																				
MR	.08	-																			
RFC	.00	.17*	-																		
ABUSE	.26**	.12	.12	-																	
NEG	.25**	.23**	.07	.24**	-																
SUSP	.15	-.10	-.09	.01	.14	-															
ATRISK	.14	.07	.07	.08	.15	.29**	-														
IEP	-.04	.06	.13	.01	-.05	.08	.20*	-													
EXT	.03	.35**	.21**	.16*	.00	.00	.19*	.37**	-												
INT	.15	.44**	.28**	.11	.18*	.05	.16	.24**	.61**	-											
COM	.03	.32**	.26**	.14	.01	.02	.16*	.32**	.90**	.72**	-										
DEV	.12	.15	-.12	-.07	.26**	.16*	.10	.29**	.10	.08	.00	-									
SUB	.03	.36**	.17*	.11	.09	.00	.19*	.14	.45**	.43**	.41**	-.03	-								
JUARR	.21**	.10	-.05	.05	.29**	.23**	.17*	.09	.19*	.23**	.13	.12	.25**	-							
JUWARR	.03	.00	-.11	.00	.11	.12	.13	.09	.05	.07	.01	.09	.04	.38**	-						
JUVARR	.23**	.09	.01	.14	.34**	.17*	.16	.05	.15	.19*	.13	.12	.11	.54**	.25**	-					
COMIT	.27**	.14	.11	.12	.14	.09	.13	.21*	.32**	.35**	.30**	.14	.26**	.30**	.25**	.32**	-				
PIC	.02	.08	.37**	.14	.13	.12	.05	-.04	-.03	.17*	-.01	-.04	.05	.03	.01	.04	.10	-			
SIC	-.10	.08	.37**	-.04	-.07	-.12	.05	.17*	.21**	.17*	.24**	-.04	.13	-.06	.01	-.04	.10	-.02	-		
DV	.13	.07	.07	.37**	.29**	.02	.04	.05	.09	.06	.11	-.04	.18*	.09	.03	.08	.14	-.02	-.02	-	
SM	.05	.13	.86**	.16*	.12	-.12	.05	.14	.20**	.26**	.24**	-.11	.23**	-.02	-.15*	.06	.10	.31**	.19*	.09	-
%	22.73	80.11	14.77	5.11	17.05	51.14	77.27	40.34	33.52	43.75	28.98	7.95	34.09	67.05	22.73	37.50	23.30	2.27	2.27	1.70	11.36
M_{age} (SD)														15.34 (1.38)	16.13 (1.16)	15.30 (1.46)					

Sources: CFSA, DCSC, DHCF, DHS, DYRS, MPD, and OSSE data submission

Note. EH: Experienced homelessness; MR: Medicaid recipiency; RFC: Removal to foster care; ABUSE: Reported abuse; NEG: Reported neglect; SUSP: Any school suspensions; ATRISK: At-risk indicator; IEP: Individualized Education Program eligibility; EXT: Externalizing disorders; INT: Internalizing disorders; COM: Comorbid disorders; DEV: Developmental disorders; SUB: Substance use disorders; JUARR: Any juvenile arrests; JUWARR: Juvenile arrests for weapon violations; JUVARR: Juvenile arrests for violent offenses (crime of violence); COMIT: Ever committed to DYRS; PIC: One or more parent ever incarcerated; SIC: One or more sibling(s) ever incarcerated; DV: ever experienced domestic violence; SM: Mother-only (single-mother) household. *$p < .05$. **$p < .01$.

Table B.3. Descriptive statistics and correlations (phi coefficients) among study variables for the non-violent group (*n* = 74)

	EH	MR	RFC	ABUSE	NEG	SUSP	ATRISK	IEP	EXT	INT	COM	DEV	SUB	JUARR	JUWARR	JUVARR	COMIT	PIC	SIC	DV	SM
EH	-																				
MR	-.02	-																			
RFC	.09	.24*	-																		
ABUSE	.20	.11	.10	-																	
NEG	.30*	.20	.06	.13	-																
SUSP	.02	-.11	-.11	.04	.14	-															
ATRISK	.18	.04	.09	.10	.17	.33*	-														
IEP	-.20	-.01	.15	-.03	-.01	.22	.27*	-													
EXT	-.06	.30**	.28*	.21	-.10	-.13	.28*	.25	-												
INT	-.03	.38**	.40**	.00	.18	-.01	.16	.20	.58**	-											
COM	-.08	.26*	.35**	.08	-.07	-.08	.24	.28*	.88**	.70**	-										
DEV	-.05	.15	-.12	-.06	.39**	.26*	.13	.37**	-.02	.16	.01	-									
SUB	-.04	.36**	.28*	.17	.12	-.03	.21	.01	.35**	.31**	.29*	-.06	-								
JUARR	.20	.09	.13	.17	.30**	.05	.19	.17	.24*	.32**	.18	.11	.28*	-							
JUWARR	.01	-.10	-.05	.22	.21	.16	.24	.04	.03	.06	.00	-.01	-.13	.42**	-						
JUVARR	.27*	.03	.08	.35**	.44**	-.06	.18	.10	.19	.19	.19	.21	.16	.47**	.22	-					
COMIT	.32*	.03	.26*	.12	.09	.02	.20	.10	.35**	.32**	.31**	.05	.18	.32**	.18	.40**	-				
PIC	.09	.09	.38**	-.03	.19	.16	.08	-.15	-.09	.24*	-.08	-.04	.07	.13	.11	.09	.18	-			
SIC	-.11	.09	.38**	-.03	-.06	-.03	.08	.23	.31**	.24*	.35**	-.04	.07	.13	.11	.09	.42**	-.03	-		
DV	.21	.06	-.05	.57**	.31**	.11	.06	-.10	-.06	-.08	-.06	-.03	.18	.09	.22	.20	-.05	-.02	-.02	-	
SM	.24	.19	.79**	.15	.14	-.21	.02	.13	.22	.32**	.28*	-.09	.34**	.10	-.18	.09	.12	.21	-.06	-.04	-
%	27.87	77.03	16.22	4.05	12.16	47.30	83.61	39.34	22.97	32.43	18.92	6.76	29.73	60.81	21.62	25.68	13.51	2.70	2.70	1.35	10.81
M_{age} (SD)														15.62 (1.27)	16.31 (1.08)	15.05 (1.39)					

Sources: CFSA, DCSC, DHCF, DHS, DYRS, MPD, and OSSE data submission

Note. EH: Experienced homelessness; MR: Medicaid recipiency; RFC: Removal to foster care; ABUSE: Reported abuse; NEG: Reported neglect; SUSP: Any school suspensions; ATRISK: At-risk indicator; IEP: Individualized Education Program eligibility; EXT: Externalizing disorders; INT: Internalizing disorders; COM: Comorbid disorders; DEV: Developmental disorders; SUB: Substance use disorders; JUARR: Any juvenile arrests; JUWARR: Juvenile arrests for weapon violations; JUVARR: Juvenile arrests for violent offenses (crime of violence); COMIT: Ever committed to DYRS; PIC: One or more parent ever incarcerated; SIC: One or more sibling(s) ever incarcerated; DV: ever experienced domestic violence; SM: Mother-only (single-mother) household. *$p < .05$. **$p < .01$.

Table B.4. Descriptive statistics and correlations (phi coefficients) among study variables for the robbery group (*n* = 57)

	EH	MR	RFC	ABUSE	NEG	SUSP	ATRISK	IEP	EXT	INT	COM	DEV	SUB	JUARR	JUWARR	JUVARR	COMIT	PIC	SIC	DV	SM
EH	-																				
MR	.16	-																			
RFC	-.14	.13	-																		
ABUSE	.30*	.16	.18	-																	
NEG	.37**	.28*	.19	.42**	-																
SUSP	.36*	-.15	-.01	-.05	.00	-															
ATRISK	.09	-.06	.06	.05	.09	.17	-														
IEP	.01	-.06	.01	-.04	.02	.02	.17	-													
EXT	.00	.46**	.15	.10	.11	.08	.14	.21	-												
INT	.26	.54**	.16	.17	.18	.14	.17	.11	.70**	-											
COM	.05	.42**	.18	.12	.06	.10	.13	.14	.93**	.78**	-										
DEV	.08	.16	-.14	-.10	.27*	.01	.05	.30*	.10	-.08	-.13	-									
SUB	.13	.32*	.12	.22	.13	-.03	.10	.18	.47**	.59**	.52**	-.19	-								
JUARR	.37**	.11	-.28*	.08	.28*	.29*	.24	.07	.22	.26*	.17	.08	.26	-							
JUWARR	.04	-.01	-.07	-.13	-.01	.08	.07	.10	.01	.12	.04	-.13	.05	.29*	-						
JUVARR	.30*	.02	-.04	.10	.28*	.30*	.14	-.08	.07	.20	.07	-.02	.08	.60**	.30*	-					
COMIT	.17	.18	.07	.18	.33*	.13	.11	.25	.12	.37**	.18	.04	.22	.32*	.31*	.35**	-				
PIC	.[c]	.07	.29*	.43**	.25	.[c]	.02	.[c]	-.12	.13	-.11	-.04	-.08	-.20	-.06	-.12	.19	-			
SIC	-.09	.07	.29*	-.04	-.07	-.17	.02	.13	.15	.13	.16	-.04	.21	-.20	-.06	-.12	-.09	-.02	-		
DV	.10	.10	.16	.28*	.35**	-.04	.03	.18	.22	.18	.23	-.06	.31*	.13	-.08	.02	.27*	-.03	-.03	-	
SM	-.14	.08	.88**	.23	.26*	-.01	.06	.01	.15	.18	.18	-.13	.20	-.16	-.04	.05	.14	.33*	.33*	.20	-
%	29.17	78.95	17.54	8.77	22.81	49.12	97.96	56.25	43.86	52.63	40.35	8.77	28.07	68.42	15.79	43.86	33.33	1.75	1.75	3.51	14.04
M_{age} (SD)														15.18 (1.39)	16.22 (1.09)	15.44 (1.56)					

Sources: CFSA, DCSC, DHCF, DHS, DYRS, MPD, and OSSE data submission

Note. EH: Experienced homelessness; MR: Medicaid recipiency; RFC: Removal to foster care; ABUSE: Reported abuse; NEG: Reported neglect; SUSP: Any school suspensions; ATRISK: At-risk indicator; IEP: Individualized Education Program eligibility; EXT: Externalizing disorders; INT: Internalizing disorders; COM: Comorbid disorders; DEV: Developmental disorders; SUB: Substance use disorders; JUARR: Any juvenile arrests; JUWARR: Juvenile arrests for weapon violations; JUVARR: Juvenile arrests for violent offenses (crime of violence); COMIT: Ever committed to DYRS; PIC: One or more parent ever incarcerated; SIC: One or more sibling(s) ever incarcerated; DV: ever experienced domestic violence; SM: Mother-only (single-mother) household. *$p < .05$. **$p < .01$. c. Cannot be computed because at least one of the variables is constant.

Table B.5. Descriptive statistics and correlations (phi coefficients) among study variables for the homicide/attempted homicide group (*n* = 45)

	EH	MR	RFC	ABUSE	NEG	SUSP	ATRISK	IEP	EXT	INT	COM	DEV	SUB	JUARR	JUWARR	JUVARR	COMIT	PIC	SIC	DV	SM
EH	-																				
MR	.19	-																			
RFC	.02	.12	-																		
ABUSE	.30	.06	-.05	-																	
NEG	.02	.18	-.15	-.07	-																
SUSP	.10	-.04	-.14	.11	.34*	-															
ATRISK	.13	.30	.08	.04	.12	.35*	-														
IEP	.17	.35*	.33*	.16	-.27	-.09	.01	-													
EXT	.19	.31*	.24	.19	-.12	.07	-.06	.67**	-												
INT	.29	.40**	.31*	.15	.11	.02	.01	.38*	.49**	-											
COM	.16	.26	.30*	.22	-.06	.08	-.10	.54**	.86**	.66**	-										
DEV	.42**	.12	-.10	-.05	.06	.23	.08	.16	.24	.15	.13	-									
SUB	.05	.38**	.16	-.15	.01	.02	.24	.28	.61**	.42**	.50**	.16	-								
JUARR	.06	.08	.00	-.27	.26	.49**	-.10	-.13	.02	-.04	-.06	.18	.14	-							
JUWARR	.07	.14	-.22	-.11	.16	.07	-.06	.14	.13	.03	.03	.44**	.16	.40**	-						
JUVARR	.14	.25	.01	-.15	.24	.27	.02	.02	.06	.07	.01	.16	.02	.56**	.25	-					
COMIT	.38*	.24	-.01	-.09	-.15	.14	-.13	.22	.46**	.29	.35*	.34*	.42**	.23	.32*	.11	-				
PIC	-.09	.06	.48**	-.02	-.07	.11	.04	.16	.19	.15	.22	-.05	.15	.09	-.11	.15	-.09	-			
SIC	-.09	.06	.48**	-.02	-.07	-.24	.04	.16	.19	.15	.22	-.05	.15	-.27	-.11	-.15	-.09	-.02	-		
DV	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	.[c]	-	
SM	.02	.12	1.00**	-.05	-.15	-.14	.08	.33*	.24	.31*	.30*	-.10	.16	.00	-.22	.01	-.01	.48*	.48*	.[c]	-
%	23.08	86.67	8.89	2.22	17.78	60.00	94.87	51.28	37.78	51.11	31.11	8.89	48.89	75.56	33.33	48.89	26.67	2.22	2.22	0.00	8.89
M_{age} (SD)														15.15 (1.48)	15.86 (1.35)	15.36 (1.43)					

Sources: CFSA, DCSC, DHCF, DHS, DYRS, MPD, and OSSE data submission

Note. EH: Experienced homelessness; MR: Medicaid recipiency; RFC: Removal to foster care; ABUSE: Reported abuse; NEG: Reported neglect; SUSP: Any school suspensions; ATRISK: At-risk indicator; IEP: Individualized Education Program eligibility; EXT: Externalizing disorders; INT: Internalizing disorders; COM: Comorbid disorders; DEV: Developmental disorders; SUB: Substance use disorders; JUARR: Any juvenile arrests; JUWARR: Juvenile arrests for weapon violations; JUVARR: Juvenile arrests for violent offenses (crime of violence); COMIT: Ever committed to DYRS; PIC: One or more parent ever incarcerated; SIC: One or more sibling(s) ever incarcerated; DV: ever experienced domestic violence; SM: Mother-only (single-mother) household. *$p < .05$. **$p < .01$. c. Cannot be computed because at least one of the variables is constant.

Multivariable Logistic Regressions

Multivariable logistic regression analyses were performed using STATA/BE 17.0 to examine the extent to which selected childhood risk factors based on chi-square analyses increased the likelihood of individuals belonging to the homicide/attempted homicide group compared to the non-violent and robbery groups at ages 18 – 24.

Table B.6. Multivariable logistic regression analysis predicting homicide/attempted homicide group (vs. non-violent group)

Group Homicide/attempted homicide (1) vs. Non-violent (0)	Odds ratio	*p*-value	95% conf. interval
At-risk indicator	2.56	n.s.	[0.65 – 10.06]
Internalizing disorders	1.56	n.s.	[0.67 – 3.64]
Substance use disorders	1.61	n.s.	[0.68 – 3.79]
Juvenile arrests for violent offenses[28]	**2.27***	***p* < .05**	**[1.01 – 5.11]**
Constant	0.14**	*p* < .01	[0.04 – 0.51]

Sources: DCSC, DHCF, DHS, MPD, and OSSE data submission
*$p < .05$, **$p < .01$
LR chi2(4) = 12.94*
Pseudo R2 = 0.08
Note. VIFs were in an acceptable range. Multiple imputation was used to account for N/A data in the at-risk indicator (see "Missing Data").

Table B.7. Multivariable logistic regression analysis predicting homicide/attempted homicide group (vs. robbery group)

Group Homicide/attempted homicide (1) vs. Robbery (0)	Odds ratio	*p*-value	95% conf. interval
Substance use disorders	2.25†	*p* = .06	[0.97 – 5.21]
Juvenile arrests for weapon offenses[29]	2.41†	*p* = .07	[0.92 – 6.33]
Constant	0.47**	*p* < .01	[0.27 – 0.82]

Sources: DCSC, DHCF, and MPD data submission
†$p < .10$, *$p < .05$, **$p < .01$
LR chi2(4) = 7.95*
Pseudo R2 = 0.06
Note. VIFs were in an acceptable range.

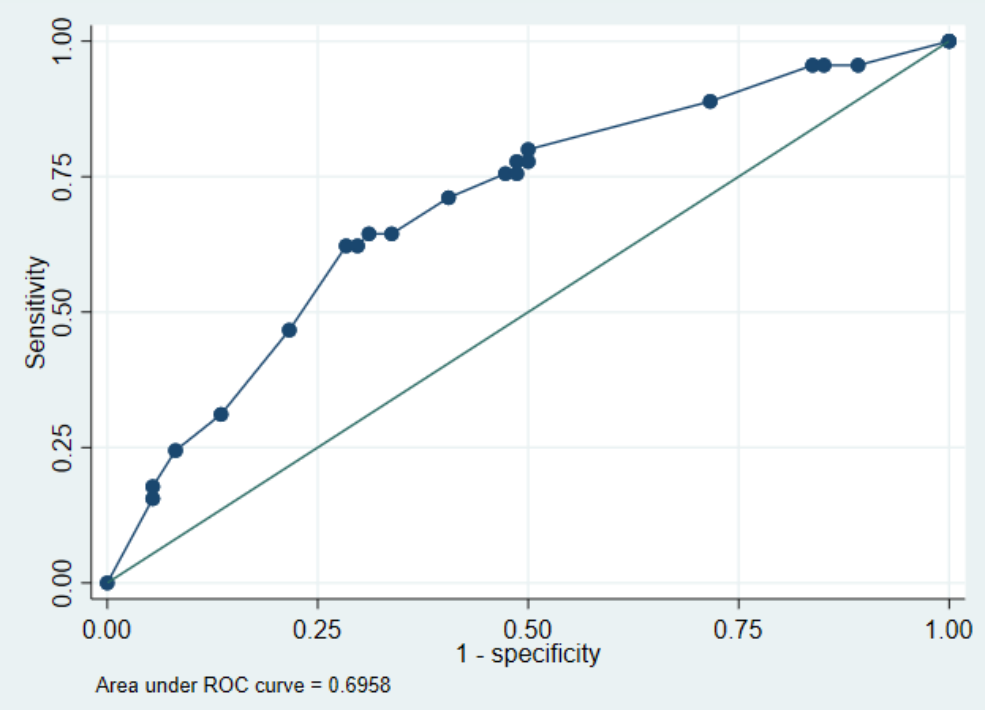
[28] For those who ever had juvenile arrests for violent offenses in the total study sample, about 74% of their arrest charges were robbery (e.g., robbery, assault with intent to commit robbery, and attempt to commit robbery).
[29] For those who ever had juvenile arrests for weapon offenses in the total study sample, about 39% of their arrest charges were possession of unregistered ammunition/firearm; about 29% of their arrest charges were CPWL; and about 23% of them were possession or carrying dangerous/prohibited weapon or destructive device.

Area Under the ROC Curve

The area under the receiver operating characteristic curve (ROC-AUC) of the statistical model predicting homicide/attempted homicide group vs. non-violent group (Table B.6.) was examined using STATA/BE 17.0 to evaluate the predictive power of the model. In general, an AUC value of 0.5 indicates no discriminative value, 0.7 to 0.8 is considered acceptable, 0.8 to 0.9 is considered very good, and more than 0.9 is considered excellent.[30]

Figure B.1. shows that the discriminating capability of the model was close to the acceptable value (0.7), with the area under the curve (AUC) = 0.6958. However, this finding should be interpreted with caution because a juvenile violent arrest history (binary predictor)[31] was the only significant predictor, and thus it was not possible to further combine risk factors into a single index (e.g., risk score) to provide more information on accurate and discriminating predictions of the statistical models. Further studies with a larger sample size are needed to draw a firm conclusion.[32]

Figure B.1. The ROC curve for the multivariable regression model predicting homicide/attempted homicide group (vs. non-violent group)



Sources: DCSC, DHCF, DHS, MPD, and OSSE data submission

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