Invited Address: Street Killings: Prediction of Homicide Offenders and Their Victims

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Abstract The article reports on childhood predictors (explanatory, behavioral and offenses) to predict homicide offenders in the longitudinal Pittsburgh Youth Study, and compares these predictors with predictors of homicide victims in the same study. This forms the basis for formulating antecedents that are shared between homicide offenders and homicide victims at a young age (ages 7–11) and antecedents that are not shared or are unique for each. Implications of the research are highlighted for early intervention and for interventions with high-risk offenders.

Introduction

Homicide rates in the United States remain among the highest in the Western World (Loeber and Farrington 2011; Brent et al. 2013). Homicide offenders tend to be also recidivist offenders, often not necessarily in terms of homicide reoffending but in terms of general delinquent recidivism (Liem 2013). About a quarter of homicides are committed by multiple perpetrators (Roscoe et al. 2012). Both murderers and their victims amount to high costs to society: DeLisi et al. (2010) reported that the average cost per murder exceeds \$17.25 million; in addition, the average murderer poses costs approaching \$24 million.

Much has been written about the causes of individuals committing homicide (e.g., Brookman 2005; Cook and Ludwig 2000; Heide 2003; Reiss and Roth 1994), but less

about the predictors and causes of individuals becoming a victim of homicide (e.g., Berg et al. 2012; Ezell and Tanner-Smith 2009; Lauritsen et al. 1991). There is a growing literature on what shared characteristics are between homicide offenders and homicide victims (e.g., Brodie et al. 2006), but there is a scarcity of studies comparing the extent to which predictors of homicide offenders overlap with predictors of homicide victims. Such studies are valuable because they can shed light on early possible causal processes that may differ for each. The theme that we want to present here is that even though homicide offenders and homicide victims to some extent share a development of deviant behavior there are also differences. For example, we will show that offenders are characterized by a higher degree of earlier deviance, and the deviance of homicide offenders is largely independent of social influences (e.g., parents' behavior), whereas social influences are much more co-occurring with early deviant behavior in homicide victims.

There are several reasons why the study of homicide offenders and homicide victims is on the one hand very difficult but on the other hand still within the realm of possibilities. The study of homicide in the streets—often of peers and strangers—as opposed to homicides in homes—often relatives or partners—shares the same methodological problems. The study of each has often relied on case histories with all the associated problems of memory bias and retrospective failure of accurate recall by perpetrators. In addition, witnesses and third-parties may over time have difficulties remembering events that led up to the homicide. Importantly, the reconstruction of motivations and long-term antecedents of homicide by scholars often takes place without the possibility of their being able to *disprove* their findings or distinguish findings from chance occurrence. These problems are particularly acute in the case of the homicide victims who can no longer report on circumstances immediately prior to

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the killing or on his or her history of problem behaviors or exposure to risk factors known to be associated with victimization. In summary, most homicide studies are based on information that was collected *after* a killing. For that reason, longitudinal studies are more important because they may contain information pertinent to what happened years *prior* to the killing (Farrington et al. 2012a, b).

Another problem concerns the prevalence of types of killings. In the United States the number of killings of relatives is much lower than the number of street killings. Therefore, it is more likely that street killings are more common in either cross-sectional or longitudinal studies of known delinquents or in large representative samples of young people, especially when studied during the peak period of the commission of homicide, which is roughly late adolescence and early adulthood. Such studies are also more likely to have information on homicide victims, who tend to be also overrepresented in that same time window.

Depending on the nature of the data collection, cross-sectional or longitudinal, the studies have different capabilities of explaining why some individuals become homicide offenders and why many do not, as well as explaining why some persons become homicide victims and most others not. The strength of the cross-sectional studies lies in the single, sometimes extensive assessment that can be linked to later homicide offending or victimization. However, the time gap between the single assessment in cross-sectional studies and the homicide often is many years, and for that reason does not take into account the impact of either very early experiences or later experiences subsequent to the single assessment that may help to explain who becomes a homicide offender or a homicide victim. For these reasons, longitudinal studies are valuable in the explanation of street homicide, especially if they have regular assessments over many years prior to the peak age of homicide, and also especially if they are based on multiple informants (e.g., parents, teachers, police and court records) that can corroborate or contradict self-reports of the individuals who are the targets of follow-ups. Importantly, longitudinal studies sometimes have data on homicide victims.

The multiple waves of measurements in longitudinal studies have yet another advantage that is allowing researchers to figure out what are long-term predictors of homicide offenders and homicide victims, thus avoiding the possibilities that explanations are just referring to cross-sectional co-occurring events or chance. Instead, the longitudinal studies have the potential capacity of establishing long-term predictors of violent outcomes, but also establish which of the predictors remain important (also called ‘independent’ predictors) once other predictors or factors are taken into account.

Also important in the study of homicide is to establish the overlap between homicide offenders and homicide victims. Although such overlap is known already for many

years (e.g., Berg et al. 2012; Lauritsen et al. 1991), previously little is known about which early behaviors in childhood (e.g., aggression, school problems) and risk factors in the home are shared by homicide offenders and homicide victims. Also, virtually nothing is known which of these antecedents predict both homicide offending and homicide victimization years later.

To our knowledge, only one general population longitudinal study in the world, the Pittsburgh Youth Study, has sufficient numbers of both homicide offenders and homicide victims to illustrate which factors, measured in childhood, independently predict homicide offenders and which factors independently predict homicide victims (Farrington et al. 2012a, b; Loeber and Farrington 2011; Loeber et al. 2005). The study also sheds light on shared factors that predict homicide offenders and homicide victims. In both instances, the study of predictors is important because that knowledge can advance our thinking of which processes lead to some individuals committing homicide and the extent to which such processes also might apply to other individuals becoming the victim of homicide.

Yet another major reason to further expand the research on the processes and causes leading to homicide offenders and homicide victims is the fact that there are large differences within those groups, where African American males, in contrast to Caucasian males, are overrepresented among *both* the homicide offenders and the homicide victims (White, in press). This onslaught usually is concentrated in those neighborhoods where African American youth live, which often means neighborhoods which are poor, with few employment opportunities, and a high prevalence of factors that predict violence and illegal activities. These activities, including drug dealing, fencing, and other black economy activities, often are associated with high levels of conflict and violence with individuals often attempting to retaliate, settling scores or take revenge without calling for the administration of justice by police or the justice system. For example, Berg and Loeber (2011, p. 13) demonstrated that ‘frequent participation in the informal drug economy is related to a higher likelihood of violent victimization’.

In summary, the present article by using data from the Pittsburgh Youth Study, addresses the following questions:

1. What are the best, independent predictors of homicide offenders?
2. What are the best, independent predictors of homicide victims?
3. Which predictors do homicide offenders and homicide victims have in common?
4. In attempts to reduce homicides, what are the advantages and disadvantages of different types of interventions?

Table 1 Design and sequence of assessments in the Pittsburgh Youth Study

<i>Youngest cohort (grade 1 at screening)</i>																		
Mean age	6.2	6.7	7.2	7.7	8.2	8.7	9.2	9.7	10.2	11	12	13	14	15	16	17	18	19
Wave	S	A	B	C	D	E	F	G	H	J	L	N	P	R	T	V	Y	AA
<i>Middle Cohort (grade 4 at screening)</i>																		
Mean age	9.5	10	10.5	11	11.5	12	12.5											
Wave	S	A	B	C	D	E	F											
<i>Oldest cohort (grade 7 at screening)</i>																		
Mean age	12.6	13.1	13.6	14.1	14.6	15.1	16	17	18	19	20	21	22	23	24	25		
Wave	S	A	B	C	D	E	G	I	K	M	O	Q	SS	U	W	Z		

The age shown is the mean age of participants at the midpoint of the 6-month or one-year period preceding the assessment

The Pittsburgh Youth Study

Design

The PYS is a longitudinal study consisting of the repeated follow-ups of community cohorts of inner-city boys, which began in 1987 (for the successive assessments used in the following analyses, see Table 1). The boys were in grades 1, 4, and 7 in Pittsburgh public schools at the outset of the study (called youngest, middle, and oldest cohorts). With the assistance of the Pittsburgh Board of Education, we started out with comprehensive public school lists of the enrollment of 1,631, 1,432, and 1,419 male students in grades 1, 4, and 7, respectively. From these lists, we randomly selected about 1,100 boys in each of the three grades to be contacted (1,165, 1,146, and 1,125 in grades 1, 4, and 7, respectively). However, a number of the children had moved out of the school district, proved to be girls or were of an incorrect age. Eventually we contacted 1,006, 1,004, and 998 families with eligible boys in grades 1, 4, and 7, respectively.

The participation rate of boys and their parents was 84.6, 86.3, and 83.9 % of the eligible boys in the youngest, middle, and oldest cohorts, respectively. Because of the high participation rate of families at the beginning of the study, we believe that the cohorts are representative of the populations from which they were drawn in the Pittsburgh public schools. A comparison of those who participated and those who did not indicated that there were no significant differences in racial distribution and achievement test results, which were the only two variables that could be compared from school records (Loeber et al. 1998). Furthermore, the cohorts are reasonably representative of boys in the general population in the City of Pittsburgh, because 72 % of all students residing within the city limits were enrolled in the public schools in 1987 (Loeber et al. 1998). Although no figures could be obtained on the differences between public school students and private or parochial school students, it is a reasonable assumption that those students not enrolled in public schools were more likely to

be Caucasian and of higher socioeconomic status than the public school students.

Screening

In order to increase the number of high-risk males, we used a screening assessment at wave S (screening at Time 1). On this basis of this screening, which used information from the participant, his parent, and his teacher, the 30 % of the boys identified as the most antisocial were included in the follow-up cohort, together with another 30 % who were randomly selected from the remaining 70 %. This strategy has the dual advantages of drawing conclusions about the population by weighting the results back to the original population (e.g., Stouthamer-Loeber et al. 1992), while maximizing the yield of deviant outcomes. This resulted in the final cohorts of 503, 508, and 506 boys in grades 1, 4,

Table 2 Characteristics of the cohorts at the beginning of the study (Wave A; Loeber et al. 1998)

Participant	Cohort		
	Youngest	Middle	Oldest
% African American	57.7	55.9	57.5
>50th percentile CAT reading score	54.5	37.6	35.2
Average age	6.7	10.0	13.1
% Held back in school	26.3	34.1	39.4
<i>Family</i>			
% Living with natural mother	95.2	92.2	94.0
% Living with natural father	39.6	41.5	37.1
% Not living with (acting) father	45.7	40.6	45.3
% (acting) mother not completed high school	17.3	18.8	19.6
% (acting) mother with college degree	6.3	5.7	7.4
% (acting) father not completed high school	16.9	16.2	20.4
% (acting) father with college degree	12.4	11.7	10.4

Numbers may slightly differ from earlier publications because of later recleaning of data

and 7, respectively, who together with their parent were to be followed up. Table 2 summarizes the characteristics of the cohorts. Aside from age they differed in the percentage of students held back in school.

Extent of the Follow-ups

The youngest cohort ($N = 503$) has been assessed face-to-face a total of 18 consecutive times from middle childhood to late adolescence (from age 7–19), while the oldest cohort ($N = 506$) has been assessed a total of 16 consecutive times from early adolescence to early adulthood (from age 13–25).¹ Assessments of each of the cohorts were carried out initially half-yearly (9 assessments for the youngest cohort, and 6 assessments for the oldest cohort), and later yearly (see Table 1). Each of the assessment intervals was contiguous (in other words, without gaps), which meant that the study is uniquely poised to investigate individuals' onset of delinquency and substance use, and individuals' continuation of and desistance from these behaviors. The middle cohort ($N = 508$) was only assessed face-to-face 7 times, at half-yearly intervals from age 10 to 13. The face-to-face data has been complemented by a variety of other data sources (see below).

Pittsburgh

Pittsburgh is largely a blue-collar city, formerly dominated by the steel industry. It is situated in the confluence of two rivers, which join to form the Ohio River. In the 2000 Census (the year in which the young males were between 20 and 26 years old) the Pittsburgh metropolitan area had about 2,358,695 inhabitants and the City of Pittsburgh had about 334,563 citizens, of which 26 % were African American, 72 % Caucasian, and the remainder (2 %) were from other ethnic groups. In 2000, the city counted 18,612 boys between ages 0 and 9, 15,220 boys between ages 10 and 17 and 24,742 young men between the ages of 18 and 24.

Pittsburgh has a very stable population; 80 % of the residents had been born in the state, compared to 62 % on average across the US only 3 % of Pittsburgh inhabitants were foreign born compared to 8 % across the US and only 2 % of the City's population was not fluent in English. The median family income in Pittsburgh was similar to that in the US as a whole, with 17 % of the children living below the poverty level. There are 90 neighborhoods in the city, many of which, because of rivers, railways or ravines, are geographically distinct. Most of the neighborhoods are

racially divided, with African Americans tending to live in the most disadvantaged neighborhoods.

Homicide Offenders and Homicide Victims

Based on information collected up to May 30, 2009, 37 PYS males were convicted for homicide committed between ages 15 and 29. The peak ages were at 18 (8 offenders) and 19 (11 offenders). The mean age of offending was 19.7. Four-fifths of offenders had committed their homicides by age 20. The arrested homicide offenders committed their alleged offenses at an average age of 22 (where this was known). Three-quarters of their offenses were committed by age 23.

In total, 39 PYS males were victims of homicide. The average age that a homicide offender committed a killing was 19.7, while the average age on death of the victims was 22.7. About 70 % of these males were killed by age 24. Excluding five boys who were not at risk, the prevalence of convicted homicide offenders was 2.4 % (37 out of 1,512), compared with 2.2 % for arrestees, and 2.6 % for victims. Weighting back to the Pittsburgh public school population, these prevalences became 2.0 % for convicted offenders, and 2.2 % for homicide victims. Of the 37 convicted homicide offenders, 32 were African American, and 37 of the 39 homicide victims. The prevalences of convicted homicide offenders were 3.7 % of African American boys versus 0.8 % of Caucasian boys (weighted figures 3.2 vs. 0.5 %). For homicide victims, the prevalences were 4.3 versus 0.3 % (weighted figures 3.7 vs. 0.3 %).

Guns were used in the majority of homicide cases involving PYS participants (27). Other cases involved knife attacks (2), vehicular homicide (1), strangulation by a cord (1), arson (1), and beatings by hand (2), a brick (1), or a metal rod (1). The motives identified were retaliation (13), robbery (7), a drug deal gone wrong (5), a gang-related dispute (3), a domestic dispute (1), arson (1), and mental illness (1). Two-thirds of the offenders had some form of prior contact with the victim (22 out of 33 known). Sixteen of the homicides were committed by a perpetrator acting alone, while 8 were committed by two offenders, and 11 were committed by three or more offenders. There was only one victim in all cases except one, where three people were killed in an arson attack.

The overwhelming majority of the victims of PYS offenders were male (34 out of 36), and most were African American (21 out of 29 known). Cross-racial offenses were rare (7). Most homicide offenses involved African American males who killed other African American males (19 out of 29 known, or 56 %). More than one-third of the victims (13 out of 38 known) were youths between the ages of 15 and 21, while another 9 were aged 22–29, and 14 were aged 30 or over. Two victims were aged 1 and 3.

¹ The youngest cohort was later followed up in the mid twenties, and that cohort and the oldest cohort recently (2010–2012) have been followed up at about ages 30 and 36, respectively.

In summary, most convicted homicide offenders appeared fairly homogeneous. The offenses often involved guns, gangs, drugs, and African American males. However, out of the 37 homicide offenders only four seemed unusual. One was mentally ill, one committed arson, one committed a domestic homicide, and one committed a vehicular homicide. We considered excluding these four cases in the predictions but decided not to, in the interests of studying a representative sample of homicide offenders.

Predictors of Homicide

In this section we address the question: To what extent do factors measured in childhood (ages 7–13) predict later homicide offenders? The answer to this question is important because it addresses the issue of the early presence of risk factors in childhood occurring prior to the murder taking place. We will focus on three types of predictors: early explanatory factors (factors in the family and neighborhood environment that are not early forms of boy's deviance or delinquency), early behavioral factors (such as conduct problems), and earlier offenses (self-report, arrest or conviction).

Turning to explanatory predictors of homicide offenders, Table 3 shows that only two out of the ten factors in his category were significant: bad neighborhood and young mother. Table 4 shows the early behavior problems that later predicted homicide. Among the strongest behavioral

Table 3 Explanatory predictors of convicted homicide offenders (Loeber and Farrington 2011)

	% Of controls (1,406)	% Of offenders (37)	Odds ratio	Partial OR	<i>p</i>
Broken family	62	89	5.0*	–	–
Bad neighborhood	32	65	3.9*	3.2	.004
Family on welfare	43	71	3.2*	–	–
Young mother	21	45	3.1*	2.5	.016
Old for the grade	25	49	2.9*	–	–
Unemployed mother	25	45	2.6*	1.9	.081
Lack of guilt	24	43	2.4*	–	–
Father behavior problems	17	32	2.4*	–	–
Low socioeconomic status	26	43	2.2*	2.0	.064
HIA	17	30	2.0	–	–

C census, *HIA* hyperactivity-impulsivity-attention deficit, *OR* odds ratio

* $p < .05$

Table 4 Behavioral predictors of convicted homicide offenders (Loeber and Farrington 2011)

	% Of controls (1,406)	% Of offenders (37)	Odds ratio	Partial OR	<i>p</i>
Suspended	43	78	4.9*	2.9	.012
High risk score	49	81	4.4*	2.2	.076
Positive attitude to delinquency	23	54	3.9*	2.9	.002
Disruptive behavior disorder	23	51	3.5*	2.1	.038
Serious delinquency	29	57	3.3*	–	–
Peer delinquency	24	49	3.0*	–	–
Positive attitude to substance abuse	24	46	2.7*	–	–
Covert behavior	24	46	2.7*	–	–
Cruel to people	24	43	2.4*	–	–
Bad friends	25	41	2.0*	–	–
Truant	38	54	1.9*	–	–

OR odds ratio

* $p < .05$

predictors were suspended from school (OR 4.9), a high risk score at screening (4.4), positive attitude to delinquency (3.9), disruptive behavior disorder (3.4), and serious delinquency (3.3). All of these, except a high risk score, remained significant in a multiple regression analysis.

The results showed that several forms of self-reported violence (such as robbery, gang fight, weapon carrying) were significant predictors of homicide offenders. In addition, several forms of self-reported property offenses predicted homicide (such as burglary, vehicle theft, theft from a car, shoplifting). Moreover, the following self-reported substance related behaviors predicted homicide, including drug selling and any drug use (results not shown in any of the tables presented here). The Odds Ratio varied from 4.2 (robbery) to 2.2 (aggravated assault). Similarly, convictions for violence and property offenses up to age 14 predicted homicide, particularly weapons charges (13.3), robbery (9.9) and several other types of convictions for violence. Further, convictions up to age 14 for property offenses also predicted homicide. Among the strongest were receiving stolen goods (6.8), larceny (5.8) and theft (4.6). Convictions for drug offenses were not among the significant predictors. A logistic regression of the preceding results (Table 5) showed self-reports, convictions and arrests each contributed to the prediction of homicide.

A final regression analysis included the significant explanatory factors, behavioral factors, and offenses, and showed that the strongest independent predictors for homicide offenders were conviction of other/conspiracy (primarily criminal conspiracy offenses, where two or more

Table 5 Logistic regression analyses predicting convicted homicide offenders (Loeber and Farrington 2011)

Based on:	LRCS	<i>p</i>	Partial OR	<i>p</i>
<i>Self reports</i>				
Vehicle thefts	18.09	.0001	2.6	.010
Weapon carrying	10.66	.001	2.8	.015
Minor fraud	4.35	.037	2.4	.047
<i>Convictions</i>				
Other/conspiracy	35.20	.0001	6.1	.0001
Simple assault	5.56	.018	3.2	.014
<i>Arrests</i>				
Other/conspiracy	31.37	.0001	4.0	.0003
Weapons	10.07	.002	3.4	.002
Simple assault	4.24	.040	2.4	.034
<i>All</i>				
Other/conspiracy (C)	34.37	.0001	3.7	.0005
Weapon carrying (S)	12.83	.0003	2.8	.013
Weapons (A)	8.27	.004	3.0	.007
Simple assault (A)	4.72	.030	2.6	.019
Minor fraud (S)	4.10	.043	2.3	.054

S self-reports, *C* convictions, *A* arrests, *LRCS* likelihood ratio Chi squared, *OR* odds ratio

people were involved in planning a crime together, OR 3.9), suspended from school (3.9), followed by self-reported weapon carrying (3.0), arrest for simple assault (3.1), positive attitude to delinquency (2.4), bad neighborhood (2.3) and, marginally, young mother (2.1). Thus, far more behavioral and offense characteristics predicted later homicide than early explanatory predictors.

What is the cumulative impact of predictors of homicide offenders? To answer that question, we made a risk score based on the significant predictors in each of the preceding regression analyses. The cumulative risk factor idea agrees with the notion that it is the accumulation of factors often operate in a cascading fashion with one risk factor triggering off other risk factors Dodge et al. (2008). Figure 1 shows that there was a dose-response relationship between the number of risk factors and later homicide offending. Virtually none of boys with zero risk factors became homicide offenders, compared with 10.3 % of boys with all four risk factors. Therefore, there was significant predictability but also a high false positive rate. Comparing boys with 0–2 risk factors with those with 3–4 risk factors produced an OR 5.4 (CI 2.8–10.7). A key predictive accuracy that is the area under the ROC curve (AUC), which was .735 (SD .042). This value is statistically significant, because it is more than 2 standard deviations above the chance value of .50.

In conclusion, most of the homicides were ‘street homicides’ and very few involved relatives, or children as

Fig. 1 Integrated risk score predicting homicide offenders (Loeber and Farrington 2011)

victims. Moreover, most of the homicides were committed by individuals who were violence-prone and had a long history of disruptive and delinquent behavior. Predictive factors to homicide were a subset of predictors of violence. Many predictors of homicide were already in place during late childhood and early adolescence. The strongest predictors were behavioral such as being suspended from school, disruptive behavior disorder, and having a positive attitude to delinquency. These behavioral risk factors were stronger predictors than were explanatory risk factors. Thus, the problem behaviors appear the strongest driving forces toward later homicide. We also know that behavioral deviance, particularly conduct disorder (which includes different forms of delinquency) is a predictor of gun carrying (Loeber et al. 2004), and that gun carrying, especially among delinquents, increases the probability of committing homicide (Cook and Ludwig 2000).

Further, unpublished results from the Pittsburgh Youth Study show that 20 % of the boys in the youngest and oldest samples reported carrying a gun before the age of eighteen (Loeber 2013), which is clearly illegal. The study also shows that boys' access to weapons (handgun, shotgun, or rifle) was facilitated by the fact that among the households in which such a weapon was kept, between 24.8 and 44.0 % of the weapons were not locked up (Loeber 2013).

Prediction of Homicide Victims

As mentioned, among the participants in the Pittsburgh Youth Study, 39 died because of violence (2.6 %). These were almost all young African American males (93 %). In Pittsburgh, the homicide victimization rate has increased for African Americans between 1997 and 2007, a trend not mirrored by higher victimization for Caucasians (Loeber and Farrington 2011). More than one in twenty individuals (6.3 %) in the youngest and oldest samples has been wounded by guns, but survived.

Which factors in childhood best predicted homicide victims? Again, the analyses were subdivided in explanatory,

Table 6 Explanatory predictors of homicide victims (Loeber and Farrington 2011)

	% Of controls (1,406)	% Of victims (39)	Odds ratio	Partial OR	<i>p</i>
Lack of guilt	24	62	5.0*	4.5	.0001
Broken family	62	87	4.1*	3.1	.035
Low achievement (CAT)	24	51	3.4*	2.3	.016
HIA	17	36	2.7*	–	–
Old for the grade	25	46	2.6*	–	–
Low achievement (PT)	24	44	2.5*	–	–
Father behavior problems	17	33	2.5*	–	–
Large family size	21	38	2.3*	2.3	.023
Family on welfare	43	62	2.2*	–	–
Bad neighborhood (P)	24	41	2.2*	–	–
Bad neighborhood (C)	32	49	2.0*	–	–
Callous-unemotional	24	38	2.0	–	–

CAT California achievement test, HIA hyperactivity-impulsivity-attention deficit, P parent, T teacher, C census

* $p < .05$

behavioral, and offense predictors. Table 6 shows that eleven explanatory factors predicted later homicide victims. A regression analysis revealed that the most important, independent predictors were lack of guilt, broken family, lack of achievement, and large family size. We will come back to this potentially important finding.

Turning to behavioral predictors, Table 7 shows that fourteen factors predicted homicide offenders. Of these factors, the following remained in a regression analysis: serious delinquency, physical aggression, and bad relationship with parent. In contrast the largest number of predictors were in the offense category (details not shown), which included self-reported offenses, offenses leading to convictions or arrest. Uniformly, offenses predicted later homicide victims. A regression analysis (Table 8) showed that twelve offense types best predicted homicide victims. Among the strongest predictors in this category were conviction for drug offenses (Partial OR 3.9), arrest or self-reported receiving stolen goods (3.9 and 2.1, respectively), and self-reported aggravated assault (2.4).

A final regression analysis examined the best explanatory, behavioral and offense factors as predictors of homicide victims. Table 9 shows that six factors survived in the analysis: lack of guilt (Partial OR 3.9), arrest for receiving stolen goods (3.2), self-reported aggravated assault (2.5), low achievement (2.2), large family size (2.2), and bad relationship with parent (2.2). Thus, a combination of early behavior problems, socio-economic and social conditions best predicted who later would become a victim of homicide.

Table 7 Behavioral predictors of homicide victims (Loeber and Farrington 2011)

	% Of controls (1,406)	% Of victims (39)	Odds ratio	Partial OR	<i>p</i>
Serious delinquency	29	67	5.0*	3.5	.0006
Physical aggression	26	56	3.6*	2.0	.050
Nonphysical aggression	25	54	3.5*	–	–
Bad relationship with parent	24	51	3.3*	2.2	.024
Covert behavior	24	50	3.1*	–	–
High risk score	49	74	3.0*	–	–
Bad relationship with peers	26	49	2.7*	–	–
Suspended	43	66	2.6*	–	–
Bad friends	25	46	2.6*	–	–
Low school motivation	37	59	2.5*	–	–
Cruel to people	24	44	2.4*	–	–
Peer delinquency	24	41	2.2*	–	–
Truant	38	56	2.1*	–	–
Disruptive behavior disorder	23	37	2.0*	–	–

* $p < .05$

Again a dose–response relationship was apparent: the higher the number of risk factors, the higher the probability of homicide victims (Fig. 2). Only 4 out of 950 boys scoring 0 or 1 (0.4 %) became homicide victims, compared with 12 out of 70 scoring 4–6 (17 %) (OR 10.3). A total of 220 boys (15 %) possessed 3 or more of these risk factors, and 23 of them (10 %) became homicide victims, compared with 1 % of the remaining 1,222 boys (OR 8.8). This cutoff point identified 59 % of the homicide victims. The final AUC of .840 (SD .027) was higher than for any of the constituent scales but somewhat lower than for the prediction of convicted homicide offenders (AUC = .870). Nevertheless, it is clear from all the analyses that the explanatory, behavioral, and criminal risk factors generally predict homicide victims about as well as homicide offenders. It is clear that many homicide victims have extensive histories of delinquent offending (see also Loeber et al. 1999).

Risk Factors Shared by Homicide Offenders and Homicide Victims

Several studies have shown that homicide offenders and homicide victims share the same characteristics and predictors (e.g., Berg et al. 2012; Lauritsen et al. 1991), but not all studies agree (see review by Muftić and Hunt 2012). In the PYS the strongest predictors of homicide offenders tended also to be the strongest predictors of homicide

Table 8 Logistic regression analyses for criminal predictors (Loeber and Farrington 2011)

Based on:	LRCS	<i>p</i>	Partial OR	<i>p</i>
<i>Self reports</i>				
Vehicle theft	16.79	.0001	2.4	.028
Aggravated assault	5.21	.022	2.1	.042
Receiving	3.75	.053	2.1	.048
<i>Convictions</i>				
Receiving	12.07	.0005	2.3	.093
Drug	3.55	.060	3.7	.051
Other/conspiracy	3.53	.060	2.4	.049
<i>Arrests</i>				
Receiving	24.20	.0001	3.1	.012
Other/conspiracy	4.55	.033	2.6	.028
<i>All</i>				
Receiving (A)	23.67	.0001	3.9	.0002
Aggravated Assault (S)	8.10	.004	2.4	.019
Receiving (S)	3.75	.053	2.1	.042
Drug (C)	3.05	.081	3.9	.050

A arrests, S self-reports, C convictions, LRCS likelihood ratio Chi squared, OR odds ratio

Table 9 Final logistic regression analysis predicting homicide victims (Loeber and Farrington 2011)

Predictors	LRCS	<i>p</i>	Partial OR	<i>p</i>
Lack of guilt	26.55	.0001	3.9	.0002
Receiving (arrest)	11.87	.0006	3.2	.003
Aggravated assault (self-report)	6.89	.009	2.5	.018
Low achievement (CAT)	4.56	.033	2.2	.032
Large family size	4.46	.035	2.2	.027
Bad relationship with parent	4.44	.035	2.2	.033

LRCS likelihood ratio Chi squared, OR odds ratio, CAT California achievement test

Fig. 2 Integrated risk score predicting homicide victims (Loeber and Farrington 2011)

victims. Moreover, homicide victims were predicted at least as well as homicide offenders. Contrary to what we expected, young homicide offenders were not more

extreme than young homicide victims in their possession of either explanatory or behavioral risk factors. Among the significant explanatory predictors, homicide victims tended to be predicted more by sociodemographic and social factors and homicide offenders tended to be predicted more by individual deviant factors. Thus, homicide offenders tended to be more individually deviant while victims tended to be more socially deprived. This distinction, however, is not found in other studies, and requires replication.

Against the backdrop of common factors across homicide offenders and homicide victims, we also found that homicide offenders compared to victims were twice as likely to carry a weapon (41 vs. 20 %), engaged in persistent drug use (41 vs. 22 %), were more often gang members (28 vs. 17 %), experienced physical punishment by their parents (35 vs. 21 %), and had mothers who used alcohol during pregnancy (14 vs. 7 %).

In contrast, more of the homicide victims compared to homicide offenders had low school achievement (55 vs. 19 %), displayed physical aggression when young (55 vs. 29 %), had bad relationships with their parents (55 vs. 32 %), and engaged in counter control (41 vs. 24 %), that is as a child tended to accelerate their oppositional behavior when parents attempted to discipline them.

In summary, we found considerable overlap in predictors of homicide offenders and homicide victims. However, we also found some indication that homicide offenders were more deviant earlier in life than homicide victims and that the latter were more exposed to socio-economic and social risk factors. Thus, the homicide victims and homicide offenders displayed an array of well-known behavioral risk factors earlier in life, but in addition, homicide victims had been exposed to several social risk factors. Future studies need to replicate this finding before it is interpreted as substantive etiological difference between homicide offenders and homicide victims.

We also found that understanding of offending requires an understanding of victimization and that one needs to study the sequence in offending and victimization within individuals and for high-risk categories of offenders. Among the explanations why African American youth are overrepresented among homicide offenders and homicide victims, we should mention that youth in that category are more exposed to a whole range of risk factors associated with violence (e.g., Fite et al. 2009).

There are several limitations to the above results. The N's were modest, and the results pertain mostly to street homicides. Whereas the focus was on explanatory, behavioral and offense factors as predictors of homicide offenders and homicide victims, the report did not include protective factors that are relevant as buffers to violence (Lösel and Farrington 2012).

When to Intervene?

Few people will disagree that homicide rates in the United States are among the highest in the Western world and that it is necessary to reduce homicides (Loeber and Farrington 2011). Homicides disproportionately affect minorities, including African American young men, who one commentator characterized, live in neighborhoods that resemble Third World countries (White, in press).

Howell (2009) in his comprehensive strategy to reduce delinquency suggested implementing both remediation of known delinquents and the prevention of delinquency. We propose that there are three major intervention and prevention strategies, which can be executed simultaneously:

1. Intervene with known delinquents (downstream approach, often referred to as targeted interventions).
2. Target hardening of buildings, fences and other forms of access to property and individuals, leading to enhanced security against crime.
3. Intervene to prevent young people from becoming tomorrow's criminals (upstream approach, often referred to as the universal approach to prevention).

Here we will concentrate on options 1 and 3.

Interventions with Known Delinquents (Downstream Approach)

The results shows that many of the homicide offenders and homicide victims engage in the same delinquent activities, such as drug dealing and fencing, which are part of the 'black or underground economy'. Drug dealing is especially a high risk behavior, because drug dealers are often robbed or engaged in aggressive or violent interchanges with others. Separate analyses show that the probability of violent victimization for those who became involved in frequent drug dealing is significantly higher for those who were initially low or average violent versus high violent (Berg and Loeber 2011). Underreporting violence to the police is a major problem and tends to be higher among younger than grown-up age groups (Bosick et al. 2012), leading to a reduced effectiveness of the justice system. Another consequence for individuals' engagement in the underground economy is that both offenders and surviving delinquent victims tend to not report to the police violence committed against them or thwart reporting by third parties by means of threats and intimidation (Berg et al. 2011). On the other hand, once wounded but not killed, each category of individuals is likely to show up in emergency departments of hospitals, and are therefore to some degree detected.

Another, perhaps co-occurring shared factor between homicide offenders and homicide victims is the fact that

they live in the same neighborhoods and that these locations are characterized by a street culture in which individuals 'place a premium on the maintenance of respect, lower the threshold of personal insult..., define violations of self in an adversarial manner..., and endorse violence as an appropriate means to regulate interpersonal disputes (Berg et al. 2012, p. 364).

Thus, the important question is what to do to reduce the rate of homicide and violence in general? The following are some examples of this category of interventions, including improving ability for the police to detect crime and identify suspects, gang suppression, improve conviction rates by means of improved prosecution, and change sentencing by judges and juries to remove more high-risk criminals from the streets. Other approaches focus on recidivism reduction and include improving education, mentoring, mental health services, and skills training in facilities for juveniles and after discharge. In addition, it should be possible to restrict juveniles' access to guns. The rationale is simple: as mentioned, fire arms were the most commonly used weapon in street killings, while one-in-five of the boys enrolled in the Pittsburgh Youth Study had carried a gun prior to age 18.

The down-stream interventions that focus on known criminals have several advantages, including reducing recidivism, victimization, fear among law-abiding citizens, and promoting safe neighborhoods. However, the down-stream approach also has several disadvantages. Arrested delinquents are a smallish subset of all actual offenders, while convicted offenders are only a subset of arrested offenders. The downstream approach does not deal with offenders who eluded detection by the justice system. Further, the down-stream approach typically is embedded in the here-and-now, and does not deal with the renewal problem, in that each generation of youth spawns a new generation of delinquents. Thus, ideally down-stream interventions need to continuously refocus on the emergence of the next generations of offenders in the community. In addition, known delinquents often have a history of decades in which they have victimized others prior to conviction; these histories of victimization of others can never be undone. For example, the majority of homicide offenders in the PYS had committed serious crime for years; judging from self-reported delinquency, half (19) of the 37 homicide offenders had committed at least 40 serious delinquent acts prior to their committing a homicide. However, among the frequent offenders, the range of the rate of offending was very large (40–3,806 offenses). Other disadvantages of the downstream approach are the high cost of incarceration, educational handicaps resulting from incarceration, and civil disabilities associated with a criminal record.

In contrast to the down-stream approach, the up-stream, preventive approach has several advantages. First, a range

of effective preventive programs are available (e.g., Howell 2009) which have documented effectiveness in reducing later violence. Second, many of the programs have favorable cost-benefits (e.g., Welsh et al. 2001). Third, modeling studies show that preventive interventions are associated with significant reductions in homicide, violence, arrest, and years of incarceration (Loeber and Farrington 2011).

Early prevention can have multiple benefits, including reducing the probability of individuals committing homicide and violence in general, reducing the probability of individuals becoming homicide victims, and reducing collateral problems associated with violence, such as mental health problems, poor school performance, and responsible fatherhood. Ideally preventive interventions can take place at two levels: (a) reduction of long-term risk factors/predictors (such as disruptive behavior, physical aggression, poor parenting) and (b) reduction of proximal risk factors/predictors, such as access and use of hand guns, and the use of disinhibitors of aggression, including drug and alcohol use.

At the same time, it should be recognized that the upstream approach may have several problems. In the PYS homicide offenders, compared to other violent offenders, had received more services in the community. Thus, conventional interventions at younger ages are not necessarily effective in reducing disruptive behavior or reducing recidivism. This may only mean, however, that services provided were not necessarily those services that are known to reduce aggression and violence (Loeber and Farrington 2011). It can also mean that the behavior of future homicide offenders was more difficult to change. It should also be noted that in Pennsylvania, and probably elsewhere as well, the lack of access to early and effective services frequently results in youth becoming involved in the justice process (Models for change 2009), and that there is much less investment by federal and state government agencies in prevention than in incarceration.

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