Neighborhood Socioeconomic Disadvantage and the Shape of the Age–Crime Curve

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Objectives. We sought to better determine the way in which neighborhood disadvantage affects the shape of the age–crime curve.

Methods. We used data from the Pittsburgh Youth Study (PYS), a 14-year longitudinal study, to compare the age–crime curves of individuals in neighborhoods of different disadvantage. We visually compared observed age–crime curves, and then used generalized linear mixed models to test for differences in curve parameters.

Results. Adjusted for individual risk factors, the mixed models found that the parameters for interactions of neighborhood disadvantage with both linear age and quadratic age were significant ($P<.05$) and consistent with higher and longer age–crime curves in more disadvantaged neighborhoods. This implied that compared with boys in advantaged neighborhoods, rates of violence among boys in disadvantaged neighborhoods rose to higher levels that were sustained significantly longer.

Conclusions. These results suggested that residing in a disadvantaged neighborhood during early adolescence may have an enduring effect on the shape of the age–crime curve throughout an individual's life. (*Am J Public Health.* 2011; 101:S325–S332. doi:10.2105/AJPH.2010.300034)

One of the most consistent findings in crime research has been the variation in offending over age, described as the age–crime curve.[1] In the age–crime curve for violence, prevalence increases in early adolescence, peaks in the late teens, and decreases more slowly into older ages.[1] The same curve properties have been observed in longitudinal data for individuals and cross-sectional population data.[2–4] Understanding the parameters of the curve is paramount for the continued development of public health-based youth violence prevention programs. When following a cohort over time, the curve provides insights into the developmental progression of violence in an individual.[4,5] When looking at population data at a cross section in time, the curve provides a snapshot of prevalence rates of violence in a community.[6,7] Understanding the factors contributing to variation in the shape of the curve is important for targeting individual prevention (cohort data), as well as for predicting and preventing future violence epidemics (cross-sectional data). Though the general shape of the age–crime curve is robust,[1,8] variations are observed for specific subpopulations in start and end points and the height and age of peaks.[3,4,6,7,9–11] How and if the parameters of the curve (reflecting onset, rate of involvement, and desistance) vary have been less understood.

Neighborhood-level studies found a higher prevalence of violence in disadvantaged neighborhoods,[12–15] although results were mixed in individual-level studies.[16–18] No research quantitatively examined how specific parameters of the curve varied across neighborhoods. In disadvantaged neighborhoods, neighborhood effects might have resulted in curves that peaked higher and remained close to that peak to produce a "longer" curve. Reflecting earlier entry into or later desistance, longer curves involve sustained high prevalence rates as more individuals remain involved in violence over a longer period. This has been important in public heath for predicting possible future violence epidemics. For instance, problem behaviors often precedes violence and were measured at the school, neighborhood, or community level and have the potential to become valuable predictors of youth violence rates. What is needed to exploit that potential is a more precise understanding of a cohort's age of entry, peak, and exit from the age–crime curve to allow for identification of which behaviors can be used for prediction.

In this article, we examined whether residing in disadvantaged neighborhoods during early adolescence (when neighborhood and peers replace family as the primary milieu of social interaction) affected the shape of the age–crime curve. The neighborhood effect was estimated while controlling for individual risk factors. First, we described the shape of the age–crime curve across neighborhoods with varying levels of disadvantage. Second, we tested whether disadvantage: (1) affected the curve's linear component, which determined how quickly the curve rose to, and fell from, a peak, and (2) affected the quadratic component, which determined a peak's location and sharpness. We hypothesized that both the linear and quadratic parts of the age–crime curve differed across neighborhood disadvantage levels. We utilized both descriptive techniques and generalized linear mixed models (GLM) to test these effects in repeated measures of violence of individuals.

METHODS

Participants were from the Pittsburgh Youth Study (PYS), a 14-year longitudinal study of delinquency.[19] Boys attending the 1st, 4th, and 7th grades in the Pittsburgh Public School system during the 1987–1988 school year were randomly selected, resulting in 1517 boys (503 in the youngest cohort, 508 in the middle, and 506 in the oldest). A detailed description of the PYS study can be found elsewhere.[19]

We limited our analysis to the oldest sample, which provided the broadest age range to assess the age–crime curve. The PYS oversampled high-risk boys. We presented unweighted analyses for sample description and weighted multivariate analyses to represent the population.

Measures

The city consists of 90 well-defined neighborhoods with stable boundaries. A neighborhood disadvantage score developed by Wikström and Loeber[16] was constructed from neighborhood attributes from 1990 census variables using principal component analysis. Variables with the highest loadings were: percentage of households on public assistance (.91%), percentage of families below poverty level (.90%), percentage of nonmarried families (.89%), percentage of unemployed (.88%), median income (–.86%), and percentage of African Americans (.81%). Socioeconomic disadvantage component scores classified neighborhoods as disadvantaged (highest 25% of disadvantage scores), average (middle 50%), and advantaged (lowest 25%). The disadvantaged category was further divided between neighborhoods with and without public housing. Participants were characterized by the disadvantage category of their residence neighborhood at the study's baseline when the boys' median age was 13 years.

Violence was any positive response to: (1) attacking someone with a weapon or with intent to seriously hurt or kill, or (2) rape or forced sex measured annually.[19,20] Information was obtained from the primary caretaker using the Child Behavior Checklist,[21–23] the youth used the Self-Reported Delinquency Scale, and Youth Self-Report.[24] These instruments have been validated and used extensively to measure violence.[19]

The candidate risk factors, listed in Table 1, are all known to be strong correlates of individual involvement in violence. Data were collected using the Diagnostic Schedule for Children Parent Version,[25] the Self-Reported Delinquency Scale,[26] the Child Behavior Checklist,[23] and the Youth Self-Report.[23] It is a challenge to choose explanatory variables for outcomes that have been extensively studied without risking over adjusting or significantly increasing type 1 error. Our approach was to base the selection of risk factors on a previous analysis of the PYS that assessed many variables from the following domains: family, child (including school), peer, and neighborhood.[27]

The assessment of race in public health research is one of complexity. Many studies have found relationships between race and youth violence.[28] However, research has shown that this relationship was spurious and that the association of race and violence was due in large part to the confounding of socioeconomic disadvantage.[29,30] As Kreiger wrote, "Despite good intentions, however, the suggestion to omit 'race' and rely solely on 'class' ignores not only the persistence of racism but also a growing body of evidence that interpersonal and structural discrimination, including but not restricted to their economic repercussions, harms health across the life-course."[31] To be able to adequately understand the complex relationship between race and violence, we felt that it was important to include race as a variable in the analysis. We did not assert that race per se was a risk factor. Rather, we treated African American race of environmental, socioeconomic, or psychosocial risk, for which we wished to control. Race was self-identified by the child's parent or caretaker at screening using an open ended question.

Analysis

Descriptive analysis. We constructed observed age–crime curves by plotting the percentage of boys involved in serious violence at each age for each neighborhood disadvantage level. Using a 3-period moving average, we visually compared curves.

Analytic analysis. The units of observation were annual measures of individual involvement in serious violence. Variables in Table 1 that were considered for the multivariate model were based on bivariate analysis as described by Hosmer and Lemeshow.[32] We used the χ^2 test to identify individual risk factors that varied significantly across neighborhood disadvantage levels ($P<.20$) for inclusion in a multivariate model. GLM takes into account nonindependence in variance arising from repeated measures and clustering of individuals who resided in similarly disadvantaged neighborhoods.[33]

SAS procedure GLIMMIX (add-on to SAS/STAT 9.1 software, SAS Institute Inc., Cary, NC) was used to examine the impact of neighborhood disadvantage on the shape of age–crime curves while controlling for individual factors. Only significant covariates were included in the model. First, we estimated a model with main effects only (age, age^2, neighborhood disadvantage, and individual risk factors) to test whether violence differed across neighborhood disadvantage levels and if the curves displayed a quadratic pattern. We added interaction terms to test for neighborhood differences in the shape of the curve. The interaction of age with neighborhood disadvantage (age × disadvantage level) tested whether the linear slope component of the age–crime curve varied significantly across neighborhoods. The interaction of age^2 with neighborhood disadvantage (age^2×disadvantage level) tested whether there were differences in the level and sharpness of the curve's peak.

We assessed the improvement in model fit. The base model included all individual risk factors except age. Adding the main effects of neighborhood disadvantage and the main effects of age and age^2 each resulted in highly significant improvements ($P<.001$) in model fit. Improvement in fit was more modest ($P<.05$) when adding age × disadvantage level, and not significant when adding age^2×disadvantage level. However, the observed data in the descriptive analysis suggested there were differences in the quadratic part of the curve. We therefore fitted the model reversing the order, first adding age^2 × disadvantage and then age × disadvantage level. Again, we found that the first and not the second interaction significantly improved model fit ($P<.05$). This pattern suggested that neighborhood disadvantage interacted with both linear and quadratic age, but that a complete model with both interactions was likely to be over-specified given the infrequency of the dependent outcome. In this event, we relied on separate models with each interaction to obtain upper bound estimates of the impacts of neighborhood disadvantage on the linear and quadratic parts of the age–crime curve.

The study was approved by the University of Pittsburgh and Carnegie Mellon University institutional review boards.

RESULTS

GLIMMIX estimates were based on 4856 annual observations over 13 years from 456 subjects. At baseline, 13% of subjects lived in the disadvantaged public-housing neighborhoods; 23% lived in disadvantaged nonpublic housing neighborhoods; 51% lived in average neighborhoods; and 13% lived in advantaged neighborhoods.

Table 1 presents unweighted baseline distributions of risk factors that were significant ($P<.05$) or trended toward significance ($P<.20$)

TABLE 1—Distribution of Individual Risk Factors by Neighborhood Disadvantage Level: Pittsburgh Youth Study, Pittsburgh, PA, 1988

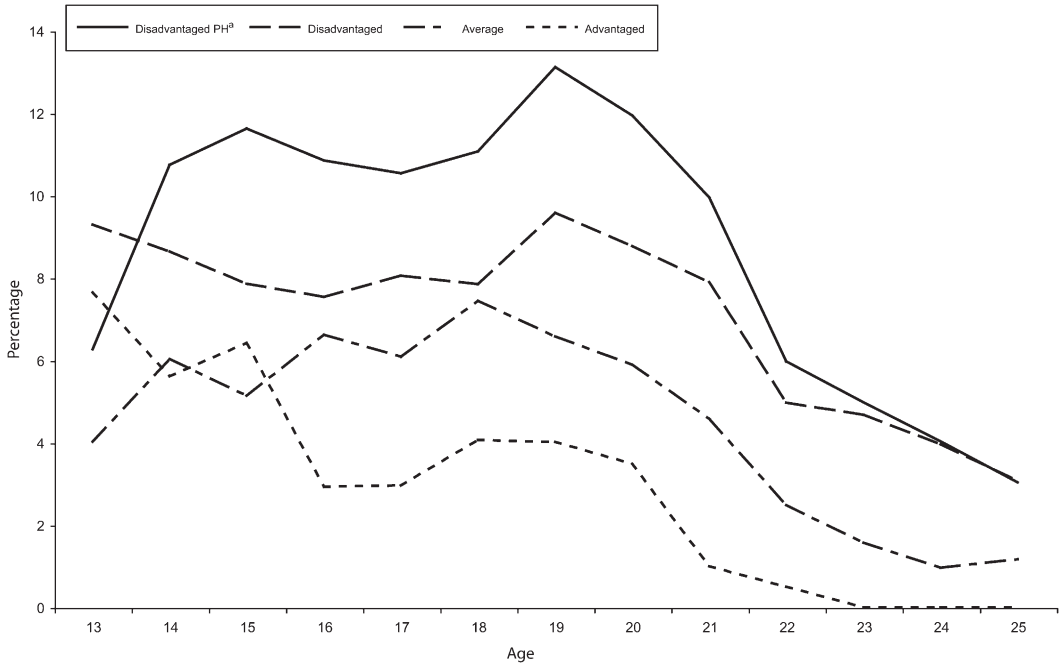
Risk Factors at Baseline	No.	All Neighborhoods (n = 503), No. (%)	Disadvantaged With PH (n = 67), %	Disadvantaged Without PH (n = 114), %	Average (n = 255), %	Advantaged (n = 67), %	*P*
Family factors							
Family SES Hollingshead (low)	495	128 (25.86)	58.73	31.86	20.24	5.97	<.001
Female SES Hollingshead (low)	481	113 (23.49)	56.45	26.13	18.03	7.81	<.001
Male SES Hollingshead (low)	251	50 (19.92)	50.00	19.57	21.62	8.51	.02
Poorly educated mother	486	96 (19.75)	33.85	21.82	18.47	6.45	.001
Unemployed mother	483	168 (34.78)	50.00	38.53	30.65	29.03	.019
Unemployed father	266	80 (30.08)	47.06	39.62	28.76	16.28	.034
Caretaker supervision	500	131 (26.20)	34.85	32.74	22.83	19.40	.043
Teenage mother of participant	476	120 (25.21)	39.39	27.62	24.70	6.90	.001
Biological father behavior problems	429	73 (17.02)	25.00	22.11	13.64	14.52	.105
Young female caretaker	483	99 (20.50)	30.77	22.73	20.16	6.67	.001
Young male caretaker	267	72 (26.97)	52.94	26.92	29.03	9.30	.001
Mother's alcohol consumption	433	57 (13.16)	22.95	11.70	12.61	7.14	.068
Biological mother/father substance use	447	130 (29.08)	36.84	32.98	28.94	16.39	.068
Poor housing	463	120 (25.92)	35.48	31.73	23.95	13.56	.019
Small house	493	107 (21.70)	46.88	3.36	15.02	7.81	<.001
Physical punishment	480	213 (44.38)	59.09	54.21	39.26	32.31	.001
Child factors							
Race (Black)	503	290 (57.65)	100.00	88.60	43.14	17.91	<.001
ADHD diagnosis	503	47 (9.34)	4.48	8.77	11.76	5.97	.205
Nonphysical aggression	503	145 (28.83)	31.34	34.21	28.24	19.40	.19
Religious observance	502	139 (27.69)	28.79	20.18	31.37	25.37	.16
Depression score	502	116 (23.11)	15.15	30.70	21.57	23.88	.093
Covert behavior	498	130 (26.10)	26.15	32.74	26.77	12.12	.025
Lack of guilt	497	128 (25.75)	28.13	32.74	26.38	9.09	.005
OPD DSMIIIR diagnosis	495	51 (10.30)	3.08	15.93	10.63	6.35	.034
Risk score	503	254 (50.50)	56.72	60.53	46.67	41.79	.027
School factors							
Held back in school	503	199 (39.56)	55.22	49.12	35.69	22.39	.001
Low academic achievement	503	127 (25.25)	23.88	30.70	26.27	13.43	.073
Peer factors							
Bad friends	501	132 (26.35)	27.27	32.74	25.88	16.42	.119
Peer delinquency	476	121 (25.42)	31.25	33.65	22.22	18.46	.049

Note. ADHD = attention deficit hyperactivity disorder; *OPD DSMIIIR* = Operationalized Psychomatic Diagnostics Diagnostic and Statistical Manual III; PH = public housing SES = socioeconomic status.

across neighborhood. Many of the significant family factors were aspects of SES. Boys residing in disadvantaged neighborhoods were more likely to have lower socioeconomic status (SES), poorly educated mothers, unemployed parents, poor housing, and a small house. Parenting skills were significantly different, although parents' behavioral and alcohol/substance use was not different. About half of child, peer, and school factors differed significantly. Boys from disadvantaged neighborhoods were more likely to be held back in school, have delinquent peers, and express lack of guilt.

Observed Age–Crime Curves

The 3-period smoothed observed age–crime curves (Figure 1) showed that more boys from disadvantaged neighborhoods engaged in violence and sustained their involvement longer. Involvement in violence for boys from the disadvantaged neighborhoods was relatively stable (about 11% and 8%, respectively) from age 14 through 18. Following a peak at age 19 (about 13% and 10%, respectively), involvement in violence steadily decreased. The observed age–crime curve of boys from average neighborhoods increased slightly from 4% in early adolescence to a peak of 7% at age 18, and then steadily decreased to 1% by age 24. For boys from advantaged neighborhoods, the observed age–crime curve peaked early at age 13 (near 8%) and then generally decreased to 0% by age 23.



Note. PH = public housing.
[a]At least 50% of housing units within disadvantaged neighborhoods are public housing.

FIGURE 1—Age–crime curves (3-year smoothed average) of percentage of youths active in serious violence, by disadvantage level of baseline residence neighborhood at age 13 years: Pittsburgh Youth Study, Pittsburgh, PA, 1988.

In general, involvement in violence was more widespread and sustained longer among boys in disadvantaged neighborhoods. The drop from peak levels of involvement occurred at a later age and was steeper during the 20s in disadvantaged neighborhoods. These results are statistically verified in the GLM discussed next.

Generalized Linear Mixed Models

Table 2 presents the results of the GLM. In the main effects model, age and age^2 were statistically significant ($P<.001$), confirming a quadratic shape. Violence was significantly more widespread among boys from disadvantaged neighborhoods with public housing than advantaged neighborhoods ($P=.03$).

The interactions of age with neighborhood type were positive and statistically significant ($P<.05$). This suggested that the upward slopes early in the age–crime curve were significantly larger for boys from disadvantaged neighborhoods. These larger positive slope coefficients contributed to a more sharply peaked age–crime curve that increased faster to a higher peak and declined slower after the peak for boys from disadvantaged neighborhoods than advantaged neighborhoods.

The interactions of age^2 with neighborhood disadvantage were positive and statistically significant ($P<.05$), slowing the exit from violence more for boys from disadvantaged neighborhoods than advantaged neighborhoods. This contributed to higher, longer, and flatter curves that sustained involvement in violence by more boys over a wider age range for boys from more disadvantaged neighborhoods. This was evident in the observed age–crime curves in Figure 1, where the share of boys involved in violence from disadvantaged neighborhoods remained at higher levels during the period of decline and did not reach zero until older ages.

Figure 2 shows the expected prevalence of violence by age and neighborhood advantage level, including the peak age and the descending one-half peak age, obtained from the multivariate estimates. The age of peak involvement in advantaged neighborhoods (13.8 years) occurred much earlier than in other neighborhoods (between ages 16.7 years in disadvantaged neighborhoods without public housing and 17.1 years in disadvantaged neighborhoods with public housing). The decline to the one-half peak level also occurred much earlier in advantaged neighborhoods (age 18.3 years) compared with other neighborhoods (between ages 21.2 and 21.7 years). This pattern suggests that desistance from violence occurred at older ages for individuals from more disadvantaged neighborhoods. Also, individual involvement in violence is higher in neighborhoods with greater disadvantage levels. This same pattern was evident in the curves of observed prevalence rates in Figure 1, providing confirmation of the model.

DISCUSSION

We found that the age–crime curves of boys who resided in more disadvantaged neighborhoods during early adolescence were significantly different from the age–crime curves of boys of the same age who resided in advantaged neighborhoods, independently of individual risk factors. Our estimates from GLM suggested that the upward slopes in the curves for boys from disadvantaged neighborhoods were significantly steeper than advantaged

TABLE 2—Parameter Estimates and Standard Errors for Generalized Linear Mixed Models of the Age–Crime Curve of Individual Involvement in Violence: Pittsburgh Youth Study, Pittsburgh, PA, 1988

Parameter	Estimate	SE	*P*
Main effects only			
Intercept	−14.490	1.803	< .001
Age	1.122	.194	< .001
Age^2	−.033	.005	< .001
Disadvantaged neighborhood with PH	1.066	.489	.03
Disadvantaged neighborhood without PH	.771	.458	.093
Average neighborhood	.709	.403	.079
Risk score	1.154	.220	< .001
Race (Black)	.517	.258	.046
Any bad friends	.568	.224	.012
Any peer delinquency	.867	.229	.001
Young female caretaker	.465	.244	.057
First-order interactions of age with neighborhood disadvantage			
Intercept	−11.419	2.207	< .001
Age	.965	.206	< .001
Age^2	−.035	.005	< .001
Disadvantaged neighborhood with PH	−2.965	1.756	.092
Disadvantaged neighborhood without PH	−2.640	1.727	.127
Average neighborhood	−2.915	1.662	.08
Age × disadvantaged neighborhood with PH	.235	.102	.021
Age × disadvantaged neighborhood without PH	.201	.101	.046
Age × average neighborhood	.213	.098	.03
Risk score	1.154	.220	< .001
Race (Black)	.517	.259	.046
Any bad friends	.572	.225	.011
Any peer delinquency	.868	.229	.001
Young female caretaker	.463	.244	.058
Second-order interactions of age^2 with neighborhood disadvantage			
Intercept	−13.164	1.868	< .001
Age	1.173	.197	< .001
Age^2	−.041	.006	< .001
Disadvantaged neighborhood with PH	−.970	.972	.319
Disadvantaged neighborhood without PH	−1.002	.948	.291
Average neighborhood	−1.115	.899	.215
Age^2 × disadvantaged neighborhood with PH	.007	.003	.023
Age^2 × disadvantaged neighborhood without PH	.006	.003	.043
Age^2 × average neighborhood	.006	.003	.034
Risk score	1.154	.220	< .001
Race (Black)	.516	.258	.046
Any bad friends	.572	.225	.011
Any peer delinquency	.867	.229	.001
Young female caretaker	.463	.244	.058

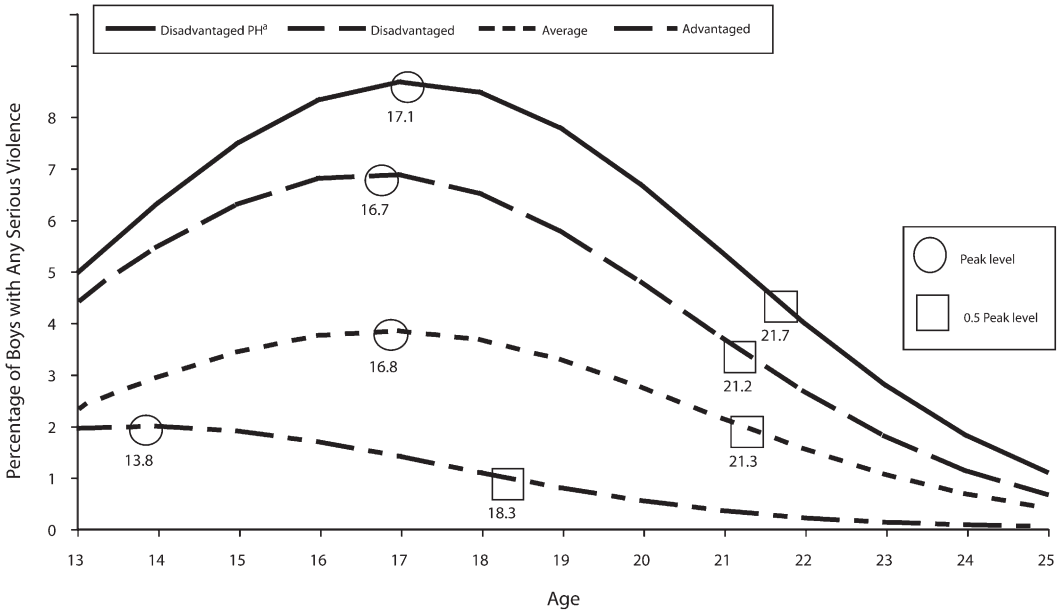
Note. PH = public housing. Advantaged neighborhoods are the reference category.

neighborhoods, contributing to a faster rise to higher levels of violence and a slower exit. The model including age^2 and neighborhood interactions indicated that the peaks in the curve were significantly wider for boys from disadvantaged neighborhoods. These results showed that more individuals in disadvantaged neighborhoods participated in violence (reflected in the main effects of neighborhood disadvantage levels), reached higher peaks (reflected in the age × neighborhood interactions), and that these higher levels of involvement persisted over a longer period of time (reflected in the age^2 × neighborhood interactions). These effects could contribute to higher prevalence rates of violence that were sustained longer over age.

Comparison to Previous Literature

Two common themes emerged in recent research on offending patterns over age: robustness of the shape of the age–crime curve and a developmental perspective on offending over the life course. Empirical results from cross sections of arrests in different times, locations, and population subgroups disagreed about whether the age distribution of offending was invariant. Relying on visual comparisons, some studies concluded that the pattern of offending over age was invariant across social and cultural conditions.[8] Relying on statistical tests of comparisons, other research challenged this conclusion, finding varying shapes in age distributions over crime types and over time in United States data for 3 years in the period from 1935 to 1985.[3] A large body of research from a developmental perspective examined patterns of individual offending over age. Piquero[4] reviewed 60 studies using 16 United States and international datasets that followed individuals longitudinally. Both the levels and shapes of the crime trajectories varied.

Previous research did not address how the shape of the individual age–crime curve varied across neighborhoods. Utilizing statistical methods appropriate for hierarchically structured data with repeated measures, we found that the shape of the age–crime curve varied significantly across neighborhood disadvantage levels. This suggested that a neighborhood's socioeconomic context could condition age patterns in individual offending. Our results were consistent with other studies examining the conditioning effects of neighborhood SES



Note. PH = public housing. [a]At least 50% of housing units within disadvantaged neighborhoods are public housing.

FIGURE 2—Generalized linear mixed model estimates of expected age–crime curves for percentage of individuals involved in serious violence, by disadvantage level of baseline residence neighborhood at age 13 years: Pittsburgh Youth Study, Pittsburgh, PA 1988.

on violence. Wikström and Loeber[16] explored how onset and prevalence of juvenile offending varied by neighborhood socioeconomic context. They found no evidence of neighborhood socioeconomic context on juvenile offending for individuals with high risk factors. However, for individuals with balanced risk and protective factors or high protective factors, neighborhood socioeconomic context influenced offending during adolescence. Examining dynamic changes in offending over age, we found a similar saliency of neighborhood disadvantage for adolescents. The annual prevalence of involvement in serious violence was higher over age, did not start to decline until older ages, and continued longer among individuals who resided in more disadvantaged neighborhoods.

Many neighborhood-level studies found a strong association between neighborhood disadvantage and neighborhood violence rates.[12–15] Peterson et al[34] examined potential interaction effects between neighborhood labor market conditions and age on neighborhood violent crime. They argued that disadvantaged neighborhoods had heightened levels because the conditions that encouraged criminal behavior were particularly pronounced and mechanisms of social control that discouraged crime were particularly lacking.[13] They examined how labor market structure affected neighborhood arrest rates for violent crime and found that labor market conditions were related to violence, but that this association was dependent on the stage in the life course.

Some research was available on the effects of public housing on neighborhood crime rates. Most studies found that public housing was associated with higher rates of juvenile violence in the surrounding neighborhood.[35,36] Peterson et al[34] found evidence that the relationship between public housing and violence was indirect and disappeared when aspects of social disorganization, particularly economic deprivation, were controlled.[34] We obtained similar results in individual-level analyses that controlled for neighborhood disadvantage measure while also controlling family and individual factors. Disadvantaged neighborhoods with and without public housing shared similar features of social disorganization (Table 1), and the age–crime curves were not significantly different.

Several limitations to the present analysis should be addressed in future studies. Our analysis did not account for residential mobility, but focused instead on the enduring effects of neighborhood disadvantage during an important developmental period. Future studies should investigate whether moving to neighborhoods with different disadvantage levels alters the shape of age–crime curve and at what age such changes might have the greatest impact. Moreover, a low prevalence of individual involvement in violence did not allow us to include both age and age^2 interactions with neighborhood disadvantage level in the same model. Additionally, the PYS data began observations at age 13 years, and so could possibly capture earlier initiation of violence. We did not test whether exposure to violence was a mediator for individual incidence of violence. Given the complexity of the present model, we chose to focus first on the direct relationships. The next logical step is to examine violence-related mechanisms through mediation and other analytic techniques.

Public Health Relevance

Knowing how age–crime curves differ by neighborhood disadvantage levels can inform the design of interventions and public policies to reduce violence. The age–crime curve provided insights into both an individual's risk of violence over his life-course as well as a snapshot of the prevalence rates of violence in

specific populations or neighborhoods. This was important for targeting prevention efforts among individuals and neighborhoods. For individuals, knowing the shape of the curve revealed at what age risk started, when risk was greatest, and when it decreased, allowing us to target prevention programs at specific age groups. Identifying systematic variation in the age–crime curve with neighborhood disadvantage provided a basis for targeting interventions geographically or temporally by predicting when future violence epidemics might emerge. By monitoring the curve, we could see whether specific cohorts entered the curve at an earlier age, possibly forecasting a change to the shape of the curve predicting increased community violence levels.

Although knowing how the shape of age–crime curve varies is important, understanding the mechanisms involved in changing the shape of the curve requires further research. Curves with sustained higher violence prevalence levels in disadvantaged neighborhoods might stem from illegitimate economic opportunities that increase rather than decrease with age, whereas legitimate economic opportunities remain scarce in these neighborhoods. For example, opportunities for gang participation and drug dealing may lead to more individuals engaging in violence and thus to an overall higher prevalence of violence, whereas earlier entry and later exit from these activities lead to a "longer" curve as higher prevalence levels of violence are sustained over a wider range of ages. From a public health perspective, interventions will likely differ depending on whether the goal is to reduce the level of involvement in violence by decreasing the number of individuals who become involved in violence, or alternatively to "shorten" the curve by delaying entry into violence and/or promoting early exit from violence. Public health officials can identify changes in the shape of the curve and prepare targeted interventions. For instance, behavioral precursors (or risk factors) for entry into the age–crime curve can occur at 4 points in the life course. These may include: (1) at infancy—hyperactivity, impulsivity, and attention problems; (2) as a toddler—aggressive/disruptive, lying, and risk-taking behavior; (3) as an early adolescent—substance use, truancy, poor academic achievement, and stealing; and (4) as a mid-adolescent—gun ownership and drug dealing as a mid-adolescent. ■

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Contributors

A. Fabio and J. Cohen originated the study. A. Fabio supervised all aspects of its implementation. J. Cohen and R. Loeber assisted with writing and critical review of the article. L.-C. Tu assisted with analyses and writing the article.

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Human Participant Protection

The study was approved by the University of Pittsburgh's institutional review board.

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