

Risk Factors for Boy's Conduct Problems in Poor and Lower–middle-class Neighborhoods

Michael A. Schonberg · Daniel S. Shaw

Received: 13 June 2006 / Accepted: 22 February 2007
© Springer Science + Business Media, LLC 2007

Abstract The joint trajectory analysis version of Nagin's (Group-based modeling of development. Cambridge, MA: Harvard University Press, 2005) semiparametric, group-based approach for modeling trajectories was used to assess how boy's trajectories of conduct problems (CP) and neighborhood SES covaried from ages 5 to 12. Participants were recruited from Women, Infants, and Children clinics when they were 18 months old. Subsequent analyses examined whether boys from poor and more prosperous neighborhoods differed in the degree to which they were exposed to familial risk factors for CP during early childhood and the extent to which risk factors for CP were generalizable across communities. Findings revealed a small, but positive relationship, between boy's trajectories of CP and neighborhood SES. In addition, chronic CP boys from more prosperous communities were found to have more child/individual risk factors for CP than their counterparts from poorer communities. Implications for prevention and intervention are discussed.

Keywords Conduct · Neighborhood · Community · Antisocial · Delinquency

Because child conduct problems (CP) are more common among children reared in communities characterized by high rates of crime and poverty (Beyers et al. 2001), many theories attribute CP to contextual factors (Bursik 1988;

Sampson et al. 1997). However, not all children who engage in antisocial behaviors come from disadvantaged environments. CP are also relatively common among children reared in safe and prosperous communities. For instance, Beyers and colleagues (2001) found that among 420 adolescents in the Pittsburgh Youth Study (Loeber et al. 1998) who had committed a physical or sexual assault between the ages of 13.5 and 17.5, 38% came from middle- to high-SES neighborhoods.

An important question is the degree to which associations between risk factors and CP depend on children's environmental context. Several studies have examined potential interactions between family and peer risk factors and community-level risk factors for CP, including: low quality parent–child and parent–parent relationships (Kupersmidt et al. 1995; Lindstrom 1996; McCord 2000), low parental supervision (Beyers et al. 2001; Pettit et al. 1999), and high peer deviance (Beyers et al. 2001). In each case, family and peer risk factors have been found to be moderated by community-risk status, with relations between CP and family and peer risk factors amplified in the context of greater neighborhood adversity. These findings suggest that separate theoretical models may be needed to account for the origins of CP in high- and low-risk communities.

However, there may be an alternative explanation for the interactive effects described above: range restriction. Some risk factors that moderate neighborhood risk are unequally distributed across high- and low-risk communities (e.g., peer deviance, family disruption; Brody et al. 2001; Kupersmidt et al. 1995). This complication makes it difficult to determine whether these risk factors interact with neighborhood risk because they are less influential in one type of community or because of more restricted variability in the range of scores. Range restriction is a

M. A. Schonberg (✉)
Western Psychiatric Institute & Clinic, University of Pittsburgh,
Pittsburgh, PA, USA
e-mail: mikesch@pitt.edu

D. S. Shaw
Department of Psychology, University of Pittsburgh,
Pittsburgh, PA, USA

potential concern because it attenuates the size of correlations between variables. Fortunately, person-oriented analytic approaches are impacted less by range restriction than variable-oriented approaches (Bergman and Magnusson 1997). Whereas variable-oriented approaches assess the strength of relationships between variables, person-oriented approaches assess how groups of individuals compare to other groups of individuals. The present study seeks to improve upon past studies of neighborhood risk by using a person-oriented approach to investigate how neighborhood risk and other CP risk factors interact over time. Although person-oriented approaches have been used for similar purposes in the past (Beyers et al. 2001; Kupersmidt et al. 1995), previous studies have relied on measures of CP and/or neighborhood risk that were collected at only one time point. As a consequence, little is known about how children's developmental trajectories of CP are affected by long- versus short-term exposure to neighborhood risk, and how, in the context of prolonged neighborhood advantage or disadvantage, other risk factors for CP alter children's trajectories of antisocial behavior.

CP and Community Context: Why Neighborhood Risk Matters

A modest but consistent relationship has been documented between neighborhood risk and CP (Ingoldsby and Shaw 2002; Leventhal and Brooks-Gunn 2000). Direct explanations for the association suggest that residence in a poor community increases CP risk because institutional resources (e.g., after-school programs) are less accessible and of lower quality in such communities (Leventhal and Brooks-Gunn 2000). Indirect explanations focus on community violence exposure, which is thought to desensitize children to the consequences of CP on others (Gorman-Smith and Tolan 1998), and the impact of neighborhood conditions on family relations. Parents from disadvantaged neighborhoods are often poor and highly stressed (McLoyd 1998). These factors increase risk for harsh and restrictive discipline strategies that promote coercive parent-child interactions (Patterson 1982). Finally, a third group of theories focus on how communities are socially organized and suggest both direct associations between neighborhood norms and child behavior and indirect neighborhood effects based on adult responses to child deviant behavior (Sampson et al. 1997; Tolan et al. 2003). For instance, Sampson et al. (1997) argue that in neighborhoods in which residents have low levels of trust for one another and are unwilling to intervene on other resident's behalf, contagion effects are more rampant because deviant peer groups are condoned by omission.

A Theoretical Explanation for Why Risk Factors for CP Should Vary across Communities

According to the social push theory proposed by Raine and Venables (1984), genetic risk factors for CP should be of greater importance in low-risk neighborhoods, and for familial and peer risk factors should be more influential in high-risk neighborhoods. Although not explicitly stated, the social push theory implies that there is a lower genetic threshold for CP among children from high-risk communities. The assumption that underlies this theory is that in high-risk neighborhoods children's genetic potentials for CP are more likely to be activated due to the presence of other CP risk factors more commonly found in such communities (e.g., poverty, deviant peer exposure). Raine and Venables refer to factors related to CP as "push factors" because they have the potential to push children towards CP even if they are only at mild genetic risk. Although push factors can be found in both high- and low-risk neighborhoods, they are far less common in low-risk neighborhoods. Thus, one would expect that for children at mild genetic risk, the likelihood of developing CP would be less in low-risk neighborhoods; whereas in high-risk neighborhoods a smaller proportion of CP variance would be expected to be accounted for by genetically-influenced child risk factors.

Previous research has generally found that familial and peer risk factors better predict CP in high- versus low-risk neighborhoods (Beyers et al. 2003; Beyers et al. 2001; Dubow et al. 1997; Eamon 2001; Hoffman 2003; Kupersmidt et al. 1995; Lindstrom 1996; McCord 2000; Pettit et al. 1999; Plybon and Kliewer 2001; Rankin and Quane 2002; Shaw et al. 2004). However, as stated earlier, most of this research has been based on variable-oriented analyses, which are highly sensitive to range restriction. In regard to how children's genetic traits interact with neighborhood risk status, no studies have been conducted on this topic. However, a few studies have examined how children's physiological functioning and child characteristics, some of which are highly heritable but also influenced by environmental conditions (e.g., ADHD; Biederman and Faraone 2002), interact with neighborhood risk. Unfortunately, these studies have yielded inconsistent findings (Beyers et al. 2001; Dabbs and Morris 1990; Farrington 1997; Lynam et al. 2000; Raine et al. 1997; Raine and Venables 1984). Clearly, more research is needed to clarify how analytic approach influences the nature of interactions between neighborhood risk and other CP risk factors and to clarify if genetically-influenced child risk factors, which will serve as proxy for genetic risk in this study, have greater impact on CP in high-versus low-risk environments.

Defining Neighborhood Risk

Although family risk factors are generally found to matter more in high-risk communities, several studies involving youth from high-risk and extremely high-risk communities have found the reverse (Gorman-Smith et al. 1999; Simons et al. 2002). This suggests that in extremely deprived communities, extra-familial push factors may be so pervasive that they overwhelm the influence of family risk factors. This raises many questions about how to define and partition neighborhood risk. Several researchers have recommended cluster analyses for this purpose (Gorman-Smith et al. 2000; Beale-Spencer et al. 1997). However, because lower-income families frequently move (Massey et al. 1994), it may be difficult to classify children's neighborhood risk in this manner across time. One potential solution is to assign children to groups based on their developmental trajectories of neighborhood risk using Nagin's (2005) semiparametric, group-based approach for modeling trajectories (SPGM). SPGM provides objective criteria for deciding how many types of trajectories exist within a population and for estimating the proportion of individuals who follow each trajectory. Assuming that multiple trajectory groups exist, the SPGM technique can separate children who are exposed to prolonged neighborhood risk from those who are exposed to intermittent risk. This distinction seems important given developmental differences in how children respond to neighborhood risk, and research suggesting that chronic stressors have a greater impact on children's adjustment than acute stressors (Korenman et al. 1995; Leventhal and Brooks-Gunn 2000).

A version of SPGM makes it possible to classify children on multiple trajectories simultaneously and then estimate relations between trajectories (Nagin 2005). In the current study, this application of SPGM will be used to generate groups within a sample of ethnically diverse males based on their joint trajectories of CP and neighborhood SES from ages 5 to 12. Subsequent analyses will examine the conditional probability of being in specific CP trajectory groups (e.g., chronic CP) given specific histories of neighborhood risk (e.g., persistent low-SES), and compare CP groups within and across neighborhood trajectory types on child and family qualities measured during infancy and the preschool years. In addition, because the social push theory rests on the assumption that children reared in poorer neighborhoods are exposed to more environmental risk factors for CP, the developmental histories of children from the SPGM-identified neighborhood trajectories will be compared irrespective of their CP trajectories.

Based on prior research and the social push theory, we hypothesized that: (1) boys exposed to prolonged neighborhood poverty would be at greatest risk for following a

chronic CP trajectory, (2) boys exposed to prolonged neighborhood poverty would have developmental histories characterized by greater exposure to familial risk factors than boys from more prosperous neighborhoods, and (3) Chronic CP boys from poorer neighborhoods would have developmental histories characterized by greater exposure to familial risk factors, but fewer child risk factors than Chronic CP boys from more prosperous neighborhoods.

Materials and Methods

Participants

Males aged 6–17 months were recruited over a 2-year period from Women, Infants, and Children (WIC) Nutritional Supplement Program Clinics in Allegheny County, PA to be part of a longitudinal study on the early precursor of CP. WIC provides nutritional aid for income-eligible families. The sample was restricted to boys because of their greater risk for CP. The only other requirement for participation was having an older sibling in the home to increase the likelihood of familial overcrowding, a CP risk factor. Of the 421 families approached, 310 (74%) elected to participate. Fifty-four percent (167) of the target children were Caucasian, 40% (124) were African-American, and 6% (19) were from other races (e.g., Hispanic American, Asian American). At recruitment, 88% of the residents in the county were Caucasian and 11% African-American. The mean per capita income of the participating families was \$2,892 per year (compared to the county mean of \$15,115), and their mean Hollingshead SES score was 24.5, indicative of a working class sample. Retention was consistently high across the 10.5-year span of the study, with 276 (89 or 65% of those approached at WIC sites) of families participating in assessments at ages 10, 11, or 12. Boys who continued to participate between ages 10 and 12 did not significantly differ from those who did not remain in the study on SES at the time of recruitment or on maternal reports of externalizing problems at ages 2 and 3.5 as measured with the 2–3 version of the of the Child Behavior Checklist (CBCL; Achenbach 1992).

Procedures

Participants were seen at ages 1.5-, 2-, 3.5-, 5-, 6-, 8-, 10-, 11-, and 12 with their mothers for 2- to 3-hour visits. During visits, mothers and sons participated in interaction tasks, and mothers completed questionnaires about their child's behavior, their own adjustment, and family functioning. Visits at ages 1.5, 3.5, 6, and 11 were conducted in

the laboratory. The other visits were conducted at the homes of the participants, except for the age-2 assessment, which was a combined home-laboratory visit. Families were reimbursed for their time after each assessment.

Measures

Conduct Problems Mothers' reports of CP were assessed at ages 5, 6, 8, 10, 11, and 12 using 18 items from the Externalizing factor of the CBCL for ages 4–16 (Achenbach 1991). The selected items (across ages, mean $\alpha=0.84$, range 0.80–0.88) reflect a broad range of serious overt (e.g., “physically attacks people”) and covert (e.g., “vandalism”) antisocial acts, as well as less-serious deviant behaviors that are common among young CP children (e.g., “temper tantrums or hot temper”; Shaw et al. 1994). It was necessary to include a broad array of items because the measure was used to model CP from ages 5 to 12, and older children tend to engage in different forms of CP than younger children and at different levels of severity (Loeber and Stouthamer-Loeber 1998). Although the entire CBCL Externalizing factor was administered, items that had poor face validity were omitted (e.g., “bragging, boasting,” “easily jealous”) to minimize the impact of behaviors that are not typically included in other CP measures.

Neighborhood SES The neighborhood SES variable was created following Wikström and Loeber (2000). First, participants' addresses were geocoded at ages 5, 6, 8, 10, 11, and 12 using data at the census tract level from the 2000 US census. Second, a list of census tracts that occurred in the sample was generated. Third, data associated with the census tracts were entered into a factor analysis at the tract level. Tracts from the same neighborhood were combined to prevent communities populated by two or more participants from unduly influencing the factor structure. Tract variables that were included in the factor analysis were: median family income, % of families below the poverty level, % of households on public assistance, % unemployed adults, % single-mother households, % of African American residents median household size, % of householders living in tract over 5 years, and % of residents aged 11–19. Participants were then assigned neighborhood scores across ages by linking the factor scores from the factor analysis to the census tracts in which they lived over time. This measure of neighborhood SES has been linked to maternal reports of neighborhood quality (Loeber et al. 1998).

Two factors were identified in the factor analysis. The factor with the larger eigenvalue (4.72) had the highest factor loadings for % of families below the poverty line (0.94), % of single mother households (0.92), and % unemployed adults (0.85). The only census tract variables

found to load below 0.40 on this factor were median household size (−0.01) and % of householders living in the tract more than 5 years (−0.23). The second factor had an eigenvalue of 1.56 and only had loadings above 0.40 for median household size, % of householders living in tract over 5 years, and % unemployed. Thus, a decision was made to base boy's neighborhood SES scores solely on the first factor. Following Wikström and Loeber (2000), neighborhood SES scores were factor derived rather than factor based, meaning that all of tract variables that were included in the factor analysis contributed to the factor score according to how they loaded on the factor.

Child Risk Factors

Difficult Temperament Observations of difficult temperament were coded from 70-min-long video recordings during the age-1.5 lab visit when boys participated in activities designed to elicit varying amounts of stress (Owens et al. 1998). Coders made ratings on a five-point scale of the amount and intensity of an infant's fussing and crying and a global rating of each child's overall difficulty. Weighted kappas for these codes ranged from 0.77 to 0.96, with a mean of 0.87. Scores for the codes were standardized and averaged together.

Behavioral Inhibition An observational assessment of nonsocial Behavioral Inhibition (adapted from Kagan 1998) was administered at age-2. Coders rated boys' behavior on two molecular and two global codes in response to an audio recording of loud and threatening noises made by gorillas in the movie, “Gorillas in the Mist.” Molecular codes included *latency to approach the cabinet* and *time in close proximity to mother*. Global ratings included *distress* (i.e., facial or vocal expressions of fear and anxiety) and *approach/avoidance* (i.e., extent to which boys approached and investigated the cabinet). Interrater reliability exceeded 0.90 for all scales. Boy's scores on these codes were standardized and averaged (mean $r=0.38$, range 0.26–0.70).

ADHD Symptoms Mothers reported on ADHD symptoms at ages 2 and 3.5 using items from the 2 to 3 version of the CBCL (Achenbach 1992) and the Larzelere Toddler Behavior Checklist (Larzelere et al. 1989). Four items relating to restlessness and inattentiveness (e.g., “can't concentrate,” “can't sit still, restless, hyperactive”) were selected for the composite ($\alpha=0.66$ and 0.68 at the age 2 and 3.5 assessments, respectively). For analyses, the ADHD symptoms scores were standardized and averaged over time ($r=0.47$, $p<0.001$).

Verbal IQ Verbal IQ was assessed at age 5.5 using the Vocabulary and Information subtests of the WPPSI-R (Wechsler 1989). These subtests correlate 0.68 and 0.75, respectively, with the full Verbal Scale score for the WPPSI-R (Sattler 1992). For analyses, scores from these subtests were averaged together ($r=0.60$, $p<0.001$).

Familial Risk Factors

Maternal Depression Mothers completed the Beck Depression Inventory (BDI; Beck et al. 1961), a measure of depressive states, at the age 1.5, 2, and 3.5 assessments. The instructions ask about symptoms over the last 2 weeks. However, to provide a more stable indicator of mood, mothers were asked about the past 6 months. Based on reports of mothers in the current sample from data collected at the age-12 assessment, this modified version of the BDI was strongly correlated ($r=0.73$) with maternal reports on the Depression scale of the Symptom Checklist-90 (Derogatis and Cleary 1977), a self-report measure of psychiatric symptoms based on the previous 2 weeks. For analyses, maternal BDI scores were standardized and averaged (r ranged from 0.65 to 0.67, in each case, $p<0.001$).

Rejecting Parenting A multi-method approach was used to measure rejecting parenting. First, reports from trained examiners were collected at age 2 using the eight-item *Acceptance* scale of the Home Observation for Measurement of the Environment (HOME; Caldwell and Bradley 1984). The *Acceptance* subscale ($\alpha=0.67$) taps parent's responses to child misbehavior or distress (e.g., "parent does not shout at the child"). Second, rejecting parenting was observed at ages 1.5 and 2 using the Early Parenting Coding System (EPCS) which consists of parenting strategies coded molecularly and globally (Winslow et al. 1995). Two of the molecular ratings, *critical statement* and *verbal/physical approval*, and three of the global ratings, *hostility*, *warmth*, and *punitiveness*, were used to create a rejecting parenting factor. Cohen's Kappa coefficients for the molecular codes and weighted Kappa coefficients for the global ratings all exceeded 0.79. Scores for these codes were standardized and summed to create one observed rejecting parenting score at each age ($r=0.37$, $p<0.001$). For analyses, the inverse of the *Acceptance* scale from the HOME and the average of the observed EPCS scores were averaged ($r=0.33$, $p<0.001$).

Attitudes about Physical Punishment As a proxy for how often parents use physical discipline, maternal attitudes about physical discipline were measured at the age-2 assessment using the Adolescent Parenting Interview (API; Bavelock et al. 1977). The API was developed to identify

parenting factors related to abuse. Sample items from the six-item scale ($\alpha=0.67$) included "Children should always be spanked when they misbehave" and "Children learn good behavior through the use of physical punishment."

Marital Satisfaction The Marital Adjustment Test (MAT, Locke and Wallace 1959) was administered to mothers at the 1.5-, 2-, and 3.5-year assessments to measure maternal satisfaction with her partner. The MAT, which has a split-half reliability of 0.90, has proven successful in discriminating harmonious and disturbed marriages (Locke and Wallace 1959). For analyses, the inverse of the age 1.5–3.5 MAT scores were standardized and averaged (mean $r=0.67$, $p<0.001$). To account for nontraditional family constellations that are more common in low-SES families (Kupersmidt et al. 1995), mothers who were not married or living with a partner were asked about their closest adult relationships or a partner from whom they had separated from within the past year. Associations between maternal MAT ratings and children's CP (using the measure described above) were not found to vary by whom the mother rated as her partner.

Data Analysis

SPGM (Nagin 2005) was used to assign boys to groups based on their joint trajectories of CP and neighborhood SES. SPGM offers multiple sources of output for determining how many trajectory groups exist within a sample. First, statistical significance of the trajectory parameter estimates for each group included in the model should be examined. A significant parameter for a group indicates that it is necessary for describing the trajectory. Nonsignificant parameters should be removed to improve fit. Second, SPGM yields a Bayesian Information Criterion (BIC), which helps identify among a series of models the optimal number of groups. Better fit is indicated by higher BIC values. The BIC is comparable to a goodness of fit test for selecting between models that are not nested, as is the case for alternate SPGM models (Nagin 2005). The BIC value associated with a model is based on the model's maximized likelihood minus a penalty for each model parameter, thereby encouraging more parsimonious solutions with fewer groups. Third, mean posterior assignment probabilities are used to determine how well the model assigns individuals to specific groups. Nagin (2005) recommends against selecting a model that has groups with mean posterior assignment probabilities below 0.70 to minimize risk of misclassification, even if the model has the highest BIC score.

For joint trajectory models, two sets of trajectories are estimated. In addition to the output described above, the joint trajectory model estimates conditional probabilities for classification into joint groups (e.g., probability of assignment to a chronic CP group given a low-SES neighborhood group). Joint trajectory models can be evaluated with the same criteria as univariate models. However, because the number of alternate models that could be explored grows exponentially as the size of the univariate models increase, Nagin (2005) recommends instructing SPGM to estimate joint trajectory models with the number of groups and parameter estimates found to be optimal in each of the univariate models tested beforehand. Decisions about fit can then be made by considering the significance of the trajectory parameters in the joint model, and by evaluating the mean posterior probabilities for the joint model.

Three types of follow-up analyses were conducted. First, conditional probabilities for membership in specific CP and neighborhood trajectory groups were evaluated and a chi-square test was conducted to examine whether CP groups were equally distributed across neighborhood trajectory groups. Second, the developmental histories of boys from the neighborhood trajectory groups were compared in a series of one-way ANOVAs to determine whether boys from poorer neighborhood groups were exposed to more familial risk factors. Finally, the developmental histories of CP groups within and across neighborhood trajectory groups were compared in a series of one-way ANOVAs to

assess whether CP boys from poor and more prosperous communities have different risk patterns. Groups were compared on the child and family risk factors described above and the number of child and family risk factors present. A risk factor was considered present for scores on measures above the sample's 75th percentile. This was chosen as the cutoff for having a risk factor because of concerns that a higher cutoff point would yield too little variability for number of risk factors present, and a lower cutoff point would identify individuals as having risk factors for traits on which they only demonstrated moderate risk. Plus, there is precedent for using the 75th percentile as a cutoff for defining a risk factor as being present (e.g., Loeber et al. 1998).

Results

Descriptive Statistics and Bivariate Correlations

Descriptive statistics for and correlations among study variables are presented in Table 1. Although both CP and neighborhood SES scores were stable across the 7 years of measurement ($r=0.40$ for CP and 0.55 for neighborhood SES, $p<0.01$ in each case), on average neighborhood conditions improved for participants and boys engaged in less CP over time. Surprisingly, CP and neighborhood SES were not significantly related (e.g., at age 5, $r=-0.10$, $p>$

Table 1 Means for and correlations between study variables

Variable	<i>M</i>	<i>SD</i>	2	3	4	5	6	7	8	9	10	11	12
1. CP, age 5	0.26	0.21	0.40*	-0.10	0.02	0.32*	-0.14*	0.09	-0.07	-0.19*	0.21*	0.03	0.28*
2. CP, age 12	0.18	0.24	-	-0.05	-0.07	0.16*	0.01	-0.01	-0.12 ⁺	-0.20*	0.15*	-0.02	0.22*
3. Neighborhood SES, age 5	-0.57	1.40	-	-	0.55*	-0.10	0.00	0.06	-0.30*	0.15*	-0.27*	-0.14*	-0.17*
4. Neighborhood SES, age 12	-0.21	1.11	-	-	-	-0.05	-0.12	0.11	0.19*	0.12 ⁺	-0.18*	-0.08	-0.17*
5. ADHD symptoms	0.80	0.38	-	-	-	-	-0.16*	0.03	-0.03	-0.17*	0.20*	0.16*	0.23*
6. Behavioral inhibition	0.00	1.00	-	-	-	-	-	0.09	0.02	0.00	-0.11	-0.06	0.00
7. Difficult temperament	13.3	5.45	-	-	-	-	-	-	-0.01	-0.12*	-0.04	0.00	0.06
8. Verbal IQ	93.6	14.4	-	-	-	-	-	-	-	-0.08	-0.35*	0.00	-0.07
9. Maternal depression	8.1	5.6	-	-	-	-	-	-	-	-	-0.10	0.02	-0.43*
10. Rejecting parenting	0.00	0.54	-	-	-	-	-	-	-	-	-	0.00	0.14*
11. Physical discipline	-0.38	0.29	-	-	-	-	-	-	-	-	-	-	0.00
12. Marital satisfaction	103	103	-	-	-	-	-	-	-	-	-	-	-

⁺ $p<0.10$, * $p<0.05$

0.10) despite sharing correlates in common (i.e., maternal reports of marital satisfaction and maternal depression). Maternal reports of CP at ages 5 and/or 12 were also predicted by maternal reports of ADHD (ages 1.5–3.5), observations of behavioral inhibition (age 2), and maternal rejection (ages 1.5 and 2). Neighborhood SES at age 5 was also predicted by maternal reports of physical discipline (age 2), observations of maternal rejection (age 2), and boy’s verbal IQ at age 5.5 ($p < 0.05$ in all cases).

Individual and Joint Trajectories of CP and Neighborhood SES

The first step in conducting a joint SPGM trajectory analysis is to identify optimal univariate models. The first CP model that was tested was limited to one group. An additional group was added to each subsequent model until the BIC score associated with each subsequent model ceased to increase. The censored normal version of SPGM, which accounts for skewed data, was used for model testing. Because SPGM can model trajectories on individuals who have missing data points, individuals who had at least two data points were included in the trajectory models ($N = 299$ or 96% of original sample of 310). To allow for nonlinear growth, group trajectories were tested using intercept, linear, quadratic, and cubic solutions. According to the criterion for evaluating SPGM models described above, the five-group solution provided the best fit. However, one of the five CP groups identified only included 1.6% of the sample, or five boys. As a group of five included too few boys from which to make meaningful comparisons with the other four CP groups, the CP model was re-estimated using only four groups, each of which followed a linear trajectory. Whereas the five group model included two groups that were involved in much higher

levels of CP from ages 5 to 12 than all of the other groups, in the four group model these groups were merged.

In regard to neighborhood SES, one to six group models were tested. Although according to BIC criteria, the six-group solution provided the best fit, when other criteria were considered, the four-group solution appeared to provide a more adequate fit. The six-group solution was faulty because one of its groups had a low mean posterior probability (0.48). The four-group solution was chosen over the five-group solution, despite its higher BIC value, because the five group solution split one of the groups from the four-group solution into two smaller groups. In the four-group model, two groups with similar slopes but different intercept values were merged. The groups that were merged had intermediate neighborhood SES levels and were adjacent to one another in rank for neighborhood SES scores. The four-group solution was deemed the better fit because it was more parsimonious, yet had much in common with the five-group solution. Researchers who use SPGM commonly opt for the more parsimonious model when having to choose between two models that only vary in slight ways, even if the larger model has a larger BIC (Brame et al. 2001; Nagin 2005). Of the four groups, one group could be defined solely by the intercept (i.e., no change), two groups were linear, and the fourth group was quadratic.

After deciding upon optimal univariate models (i.e., four CP and four neighborhood groups), the joint trajectory model was specified using the number of groups and the shape of trajectories from the univariate models. Parameter estimates for both sets of trajectories, estimated group sizes, and posterior assignment probabilities are reported on in Table 2. Trajectory patterns are displayed graphically in Figs. 1 and 2.

Of the four CP groups included in the joint trajectory model, one group engaged in low levels of CP from ages 5

Table 2 Estimated trajectory parameters, percentages, and posterior assignment probabilities for CP and neighborhood SES groups

Trajectory group	Intercept		Slope		Quadratic		Est. % of sample/group <i>N</i>	Posterior Assignment probabilities.	
								<i>M</i>	SD
	β	SD	β	SD	β	SD			
CP									
Abstainers	-0.039*	0.017	-0.030***	0.004	–	–	30.1/90	0.88	0.14
Occasional rule-breakers	0.185***	0.012	-0.012***	0.003	–	–	49.8/149	0.89	0.14
High desisters	0.383***	0.021	-0.054***	0.008	–	–	10.0/30	0.80	0.18
Chronic CP	0.563***	0.016	0.033***	0.006	–	–	10.0/30	0.94	0.12
Neighborhood SES									
Poverty-stricken-stable	-3.376***	0.142	-0.063	0.031	0.050**	0.017	5.8/17	0.97	0.08
Poverty-stricken-improve	-2.040***	0.109	0.522***	0.031	–	–	5.3/16	0.95	0.12
Lower-class	-0.873***	0.044	0.053***	0.012	–	–	34.8/104	0.96	0.10
Lower-middle-class	0.436***	0.033	–	–	–	–	54.1/162	0.93	0.14

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

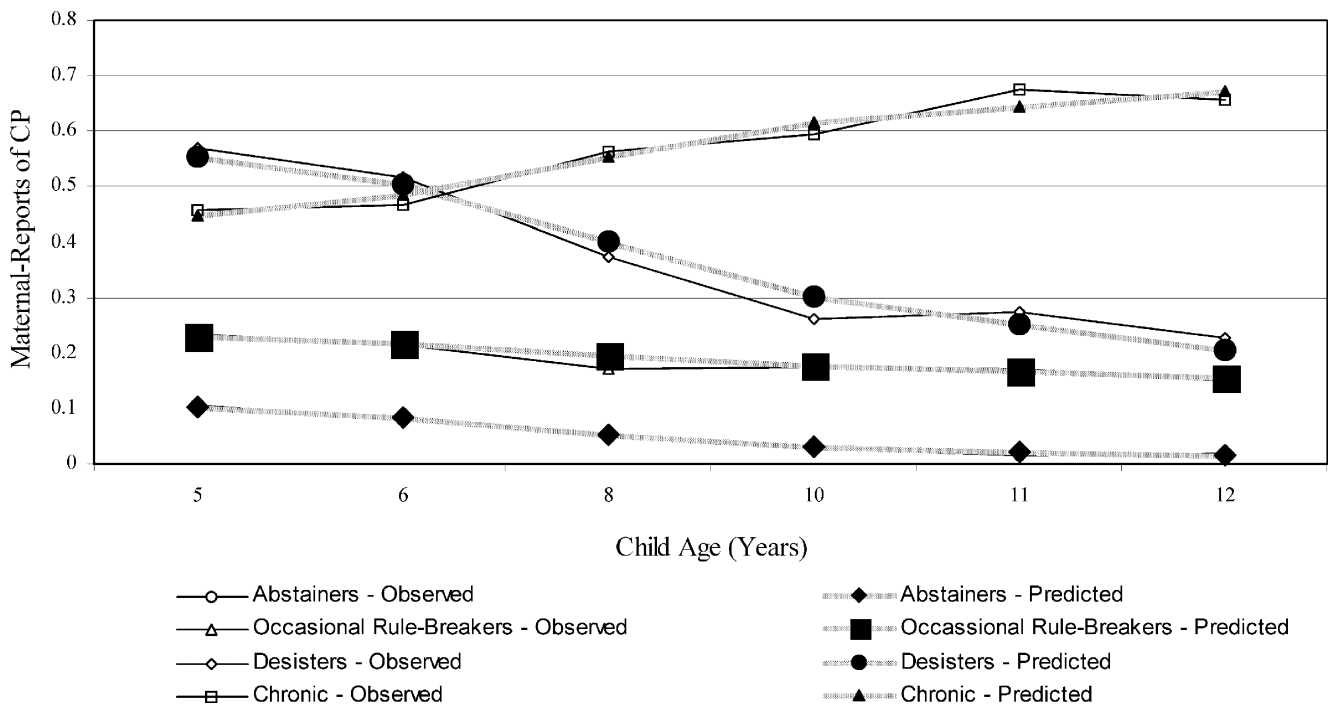


Fig. 1 Maternal reports of CP by CP trajectory group

to 12. This group will be referred to as Abstainers. Another group, referred to as Occasional Rule-Breakers, was involved in a moderate level of CP from ages 5 to 12. A third group, labeled High Desisters, was involved in the highest level of CP at age 5 but demonstrated a decline over time. Finally, the fourth group, labeled Chronic CP, was involved in almost as much CP as the High Desisters at age 5 and demonstrated consistent growth thereafter. Mean posterior assignment probabilities for the four CP groups ranged from 0.80 to 0.94 ($M=0.88$).

To verify that the Chronic group included youth with elevated levels of CP, the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Epidemiological Version (K-SADS-E; Orvaschel and Puig-Antich 1987), a diagnostic measure of psychiatric symptoms, was administered to the participants and their parents at ages 10, 11, and 12. Final decisions about diagnoses were decided upon at group meetings with all examiners and a licensed clinical psychologist with 15 years experience in using the K-SADS, with final decisions made by the licensed psychologist with

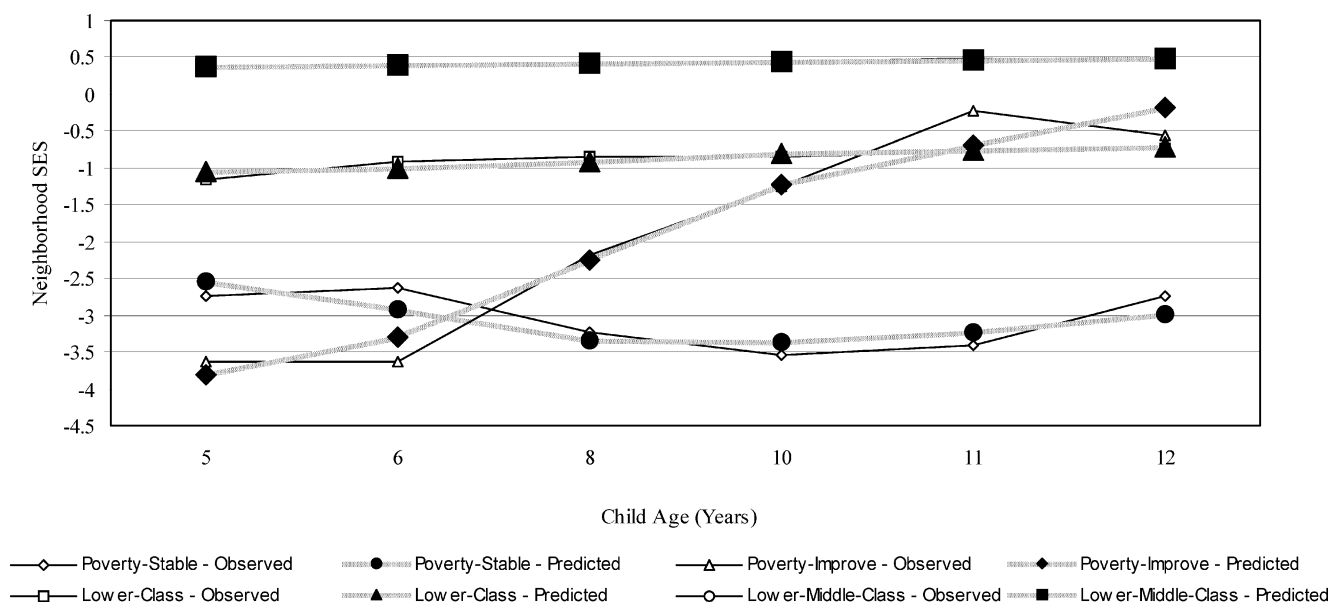


Fig. 2 Neighborhood SES scores by neighborhood SES trajectory groups

an emphasis on functional impairment. Based on K-SADS-E, 23 of the 29 youth from the chronic CP group for whom K-SADS-E data was available met diagnostic criteria for at least one disruptive behavior disorder from ages 10 to 12 (16 for Conduct Disorder, 20 for Oppositional Defiant Disorder). This suggests that the youth in the Chronic CP group generally demonstrated CP at a level that was severe enough to warrant a clinical diagnosis.

For the neighborhood model, labeling decisions were based on the census tract variables used in the factor analysis. The first group, labeled Poverty-stricken-stable, followed a stable low pattern as evidenced by the percentage of families in this group living below the poverty line (49% at age 5 and 50% at age 12) and unemployed (11% at ages 5 and 12). The second group, labeled Lower-middle-class, demonstrated stability at the upper-end of the socioeconomic strata, as evidenced by lower rates of poverty (9% at age 5 and 8% at age 12) and unemployment (4% at ages 5 and 12). The third group, labeled Lower-class, demonstrated high poverty rates (25% at age 5 and 20% at age 12) and unemployment (9% at age 5 and 6% at age 12), but lower rates than the Poverty-stricken-stable group. Finally, a fourth group, labeled Poverty-stricken-improve, demonstrated movement from lower to higher SES neighborhoods (i.e., poverty rate shifted from 57% at age 5 to 14% at age 12 and unemployment decreased from 18 to 6%). Mean posterior assignment probabilities for these groups ranged from 0.93 to 0.97 ($M=0.95$).

Overall, the joint trajectory analysis described above created 16 groups. Group sizes and assignment probabilities for the groups it created are detailed in Table 3.

Conditional Probabilities for CP Groups Given Neighborhood Risk History

Table 3 contains conditional probabilities for being assigned to the four CP groups given membership in one of the four neighborhood SES groups. A chi-square test (16 cells, four CP groups by four neighborhood SES groups) was conducted to assess whether boys from the various neighborhood groups were equally distributed across CP groups. The chi-square statistic associated with this test was found to be significant ($\chi^2=16.68, p<0.05$). As a follow-up, Wald tests were conducted to help clarify within and across neighborhood groups which CP groups had significantly different conditional probabilities. As shown in Table 3, for all of the neighborhood groups besides the Poverty-stricken-stable group, the probability of assignment to the Chronic CP group significantly differed from the probability of assignment to the Abstainer and/or Occasional Rule-breaker groups (in each case, $p<0.05$). The Wald tests also revealed that boys from the Poverty-stricken Stable neighborhood groups were at significantly greater risk for assignment to the Chronic CP group than boys from the other three neighborhood groups (in each case, $p<0.05$), and that boys from the Poverty-Stricken-Improve neighborhood group had the lowest probability of being assigned to this CP group (in each case, $p<0.05$). No differences were found across neighborhood groups for probability of assignment to the Abstainer and High-Desister groups. However, boys from Poverty-stricken-stable neighborhoods had a decreased likelihood of assignment to the Occasional Rule-breaker groups relative to the boys from the Poverty-stricken-improve and Lower-middle-class neighborhood groups (in each case, $p<0.05$).

Table 3 Groups sizes and joint and conditional probabilities of assignment in joint CP/neighborhood trajectory groups

	Abstainers	Moderate-stable	High desisters	Chronic
Group sizes and joint probability of CP and neighborhood group				
Poverty-stricken-stable	4 (0.017)	5 (0.012)	3 (0.011)	5 (0.018)
Poverty-stricken-improve	3 (0.009)	9 (0.035)	3 (0.010)	0 (0.000)
Lower-class	30 (0.115)	48 (0.163)	12 (0.043)	7 (0.026)
Lower-middle-class	49 (0.161)	93 (0.288)	10 (0.037)	18 (0.056)
Probability of CP group conditional on neighborhood group				
Poverty-stricken-stable	0.301	0.211 ^{AB}	0.184	0.304 ^{CDE}
Poverty-stricken-improve	0.167	0.650 ^{Aa}	0.183 ^b	0.000 ^{CFGab}
Lower-class	0.329 ^{cd}	0.470 ^{ef}	0.125 ^{ce}	0.076 ^{DFdf}
Lower-middle-class	0.297 ^{ghi}	0.532 ^{gikB}	0.068 ^{hji}	0.104 ^{EGikl}

Conditional probabilities with the same superscripts (i.e., same letter and same case) differ significantly at the $p<0.05$ level according to Wald tests. Equal size groups from the same neighborhood type may have different joint probability values because SPGM assigns individuals to groups probabilistically based on how confident it is that an individual belongs to the group to which he has been assigned.

Table 4 Mean risk scores for familial risk factors by neighborhood trajectory group

	Poverty-stricken-stable (<i>N</i> =17)	Poverty-stricken-improve (<i>N</i> =15)	Lower-class (<i>N</i> =97)	Lower-middle-class (<i>N</i> =170)
Maternal depression	0.48 ^a (1.10)	0.21(1.20)	0.05(0.93)	-0.07 ^a (0.84)
Rejecting parenting	0.35 ^c (0.49)	0.27 ^d (0.69)	0.08 ^c (0.58)	-0.11 ^{cde} (0.47)
Physical discipline	-0.29(0.43)	-0.13(0.53)	-0.09 ^b (0.61)	-0.31 ^b (0.68)
Marital satisfaction	-0.35(1.08)	-0.18(0.70)	-0.04(0.84)	0.06(0.84)

Means with the same superscripts differ significantly at the $p < 0.05$ level. Standard deviations are reported in parentheses.

Comparison of Familial Risk Factors across Neighborhood Groups

A series of one-way ANOVAs were conducted in which the developmental histories of the neighborhood SES groups (i.e., independent variables) were compared on family risk factors. Results are presented in Table 4. Overall, children from the Lower-middle-class neighborhood group were exposed to lower levels of familial risk than children from the other neighborhood SES groups, including less parental rejection than children from all of three of the poorer neighborhood groups, fewer maternal depressive symptoms than the children from the Poverty-stricken-stable neighborhood group, and less favorable views of physical discipline than the mothers of children from the Lower-class neighborhood groups (in each case, $p < 0.05$).

Risk Factors for CP across and within Neighborhood Trajectory Groups

To limit the number of group comparisons, only those relevant to hypothesis 3 were conducted. Thus, for the across-neighborhood group comparisons, only the Chronic CP groups from diverse neighborhood backgrounds were compared, and for the within-neighborhood group comparisons, only the Chronic CP groups were compared to the Abstainer and Occasional Rule-Breaking groups. Because some of the joint trajectory groups identified by SPGM only included a few boys, CP groups from distinct neighborhood SES groups were combined to ensure at least marginal power for subsequent analyses. For example, the Chronic CP groups from the poverty-stricken and Lower-class neighborhood groups were merged to create a 12-member Chronic CP/Lower-SES neighborhood group that was comparable in size to the 18-member Chronic CP/lower-middle-class neighborhood group. Before their merger, the Chronic CP groups from the poorer neighborhood groups only included five, zero, and seven children. For consistency, the Abstainer and Occasional Rule-

Breaking groups within the three poorer neighborhood groups were combined with their respective counterparts in the same manner. Researchers who use SPGM commonly combine groups in this manner to increase power (Seguin et al. 2004; Shaw et al. 2003). Although this procedure reduced differences across the environments in which CP predictors were compared, analyses comparing the Lower-middle-class neighborhood group to the aggregated Lower-SES neighborhood group indicated that these groups still significantly differed on the study's Neighborhood SES factor and all of its individual components. In many cases, these differences were dramatic. For instance, three to four times as many families were on public assistance in the neighborhoods in which participants from the combined Lower-SES neighborhood group were living at age 5 than the boys in the Lower-middle-class neighborhood group (32 vs. 9%, $F(1, 298) = 223.97$, $p < 0.001$).

Table 5 presents the results of the ANOVA analyses comparing Chronic CP groups across neighborhood types. Despite small group sizes (18 vs. 12), a significant difference ($p < 0.05$) was found in the extent to which chronic CP boys from Lower-middle-class and Lower-SES neighborhoods demonstrated child risk factors for CP during early childhood, including higher levels of ADHD symptoms and difficult temperament, and lower levels of behavioral inhibition and Verbal IQ. More specifically, chronic CP boys from Lower-middle-class neighborhoods were found on average to have 1.83 of the child risk factors mentioned above compared to 1.08 of the child risk factors for chronic CP boys from Lower-SES neighborhoods. Regarding specific child and family risk factors, two marginally significant differences ($p < 0.10$) were found. Chronic CP boys from the Lower-middle-class neighborhood group had higher verbal IQs and less exposure to parental rejection than those in the Lower-SES group.

For the within-neighborhood trajectory group comparisons, the Chronic CP groups from the Lower-middle-class and Lower-SES neighborhoods were compared to their Occasional Rule-breaking and Abstainer groups from the

Table 5 Mean risk scores for chronic CP boys from lower-SES and lower–middle-class neighborhoods

	Chronic CP/lower-SES neighborhood groups (N=12)	Chronic CP/lower–middle-class neighborhood group (N=18)
No. of child risk factors	1.083 ^a (0.842)	1.830 ^a (0.826)
ADHD symptoms	0.448 (0.800)	0.273 (0.921)
Behavioral inhibition	–0.093 (1.424)	–0.480 (1.105)
Difficult temperament	11.753 (4.776)	14.679 (6.479)
Verbal IQ	83.511 (8.681)	93.906 (14.758)
No. of family risk factors	2.056 (1.238)	1.630 (1.053)
Maternal depression	0.421 (0.732)	0.625 (1.238)
Rejecting parenting	0.418 (0.668)	0.078 (0.494)
Physical discipline	–0.125 (0.856)	–0.324 (0.643)
Marital satisfaction	–0.427 (1.153)	–0.579 (0.795)

Means with the same superscripts differ significantly at the $p < 0.05$ level. Standard deviations are reported in parentheses.

same neighborhood background. Significant group differences ($p < 0.05$) are highlighted below. In the Lower–middle-class neighborhood group, Chronic CP boys had more child and family risk factors for CP during early childhood than the Abstainers and Occasional Rule-breakers. Regarding specific child and family risk factors, the Chronic CP boys were found to have had greater exposure to maternal rejection and demonstrate more ADHD symptoms during early childhood than the boys from the Abstainer group. In addition, their mothers reported more depressive symptoms and less marital satisfaction than the mothers of the Abstainers and Occasional Rule-breakers from the same neighborhood group. In regard to the Lower-SES neighborhood group, Chronic CP boys were found to have had more familial risk factors during early childhood than the Abstainers and Occasional Rule-breakers, significantly higher levels of ADHD symptoms during early childhood than the Abstainers, and greater exposure to maternal rejection than the Occasional Rule-breakers.

Discussion

This study had three aims. The first was to examine whether there was a relationship between boy's histories of CP and neighborhood risk. Based on prior research and

theory about how neighborhoods influence children, it was hypothesized that boys from poorer neighborhoods would be more likely than their peers from more prosperous neighborhoods to follow a chronic CP trajectory. Consistent with previous research on how neighborhoods influence children (Ingoldsby and Shaw 2002; Leventhal and Brooks-Gunn 2000), this hypothesis was confirmed. Using SPGM to examine how trajectories of CP and neighborhood SES relate, we were able to corroborate their association and demonstrate how long-term exposure to neighborhood poverty has a more deleterious effect on children's CP trajectories than brief exposure.

A second aim was to examine whether boys from poorer neighborhoods were exposed to more familial risk factors for CP than boys from more prosperous neighborhoods. As is implied by Raine and Venables' (1984) social push theory, boys from poorer neighborhoods were generally found to be exposed to more familial risk factors than their peers from lower–middle-class neighborhoods. Maternal rejection, maternal depressive symptoms, and maternal views on physical discipline were found to differentiate boys from these neighborhood types. These findings shed light on why boys from poor communities are considered to be at greater CP risk.

Finally, a third aim was to compare CP risk factors within and across neighborhoods that vary in SES. Despite small group sizes, Chronic CP boys from Lower–middle-class neighborhoods were found to have more child risk factors for CP during early childhood than Chronic CP boys from poorer neighborhoods. Furthermore, whereas Chronic CP boys from Lower–middle-class neighborhoods were found to differ from Abstainer and Occasional Rule-breakers in number of family and child risk factors, Chronic CP boys from poorer neighborhoods were only found to differ from these groups in the number of family risk factors. These findings are partially consistent with social push theory, as they suggest that in Lower–middle-class neighborhoods, frequency of both family and child risk factors matter, but in poorer neighborhoods only the frequency of family risk factors discriminate CP groups.

Regarding specific child and family risk factors, findings suggested that ADHD symptoms and maternal rejection were related to CP regardless of community context. Both risk factors differentiated between Chronic CP and non-CP boys in Lower–middle-class and Lower-SES neighborhoods. On the other hand, maternal depression and marital satisfaction were only found to differentiate between Chronic CP boys and non-CP boys in Lower–middle-class neighborhoods. According to social push theory, familial risk factors such as maternal depression and marital satisfaction should be more closely related to CP in poorer neighborhoods. Perhaps maternal depression and marital satisfaction, a well-established correlate of maternal depres-

sion (Davila et al. 2003), were not consistent with the tenets of the social push theory because they affect children's trajectories of CP through genetic as well as environmental means. Theoretically, if mothers in lower-SES communities are faced with greater levels of social adversity than mothers in higher-SES neighborhoods, then mothers who demonstrate high levels of depressive symptoms in higher-SES environments might do so primarily because of genetic influences. This explanation, although speculative, would be consistent with social push theory, and is supported by research demonstrating that depression is heritable (McGue and Christensen 1997) and that children's CP is predicted by their mother's depressive symptoms (Kim-Cohen et al. 2005). Alternatively, it is possible that the findings for maternal depression and marital satisfaction were inconsistent with social push theory because it only has relevance for how groups of risk factors (e.g., sum of child risk factors), rather than specific risk factors, relate to CP across diverse community settings.

Pending corroboration, the findings could be pertinent to prevention in several ways. First, they suggest that boys from low-income neighborhoods, particularly those exposed to chronic neighborhood poverty, should be targeted for prevention because they are at increased risk for chronic CP. However, to conserve resources and decrease false positive rates, it would appear more efficient to only target boys from poor communities who also have additional CP risk factors, as associations between boy's trajectories of CP and neighborhood SES were only modest. In this study, ADHD symptoms and maternal rejection were the only risk factors found to distinguish between Chronic CP boys from Lower-SES neighborhoods and their less deviant counterparts with similar neighborhood backgrounds. For boys from more prosperous communities, ADHD symptoms and maternal rejection played a similar role in differentiating between Chronic CP and less deviant youth. In addition, mothers of Chronic CP boys reported more depressive symptoms and less marital satisfaction during early childhood than the mothers of less deviant boys. These findings suggest that boys from higher-SES communities with this constellation of child impairment, negative parenting, and family stress should be targeted for prevention despite the protection against CP afforded to them by their place of residence.

This study had several limitations. First, the sample was primarily limited to Caucasian and African American boys. Also, the sample contained fewer boys from upper-SES homes than would be ideal for testing the social push theory. However, despite having histories of low-SES, many of the participants were able to live in middle-class neighborhoods, particularly as they grew older. By age 10, 55% of the participants were living in middle-income neighborhoods, and 15% were living in high-SES neigh-

borhoods using neighborhood classifications created by Wikström and Loeber (2000). Also, it should be noted that Wikström, and Loeber found that neighborhood factors only affect children above and beyond the impact of other child and family risk factors in the most deprived communities. This suggests that it may not be necessary to include youth from the highest-SES communities to accurately test social push theory as long as youth from deprived communities are compared to children from moderately less deprived communities, as was the case in the present study. Another concern was the sample size. SPGM typically identifies additional groups with larger samples (Eggleston et al. 2004). Furthermore, because SPGM divided the sample into so many small groups, the chi-square test assessing how trajectories of CP and neighborhood SES covary may have been unreliable. Moreover, there was only sufficient power for detecting large effects for the analyses that compared CP groups. For instance, power for detecting differences between Chronic CP groups across neighborhoods was 0.91 for large effects, but only 0.16 for small effects. To increase power, various neighborhood and CP groups were combined, but this may have obfuscated variation in developmental histories among individual groups. Thus, analyses comparing the developmental histories of CP groups should be viewed as exploratory. Another concern was that for some analyses, the same informant was used to measure CP and predictor variables. Variables measured via the same informant tend to correlate more than measures based on reports from multiple informants. Additionally, although this study aimed to test social push theory in relation to neighborhood context, its validity could only be inferred because genetic risk factors were not included. Genetically-influenced child risk factors were used in place of genetic risk factors, but these qualities are also influenced by the environment (Biederman and Farone 2002; Turkenheimer et al. 2003; Wachs and Bates 2001). Future studies should measure genetic risk factors and/or incorporate genetically-informed research designs (e.g., twin, adoption designs), as well as include other nonmeasured correlates of CP (e.g., parental substance abuse, parental deviance). Finally, even though predictor variables were measured prior to the first assessment points for CP and neighborhood SES, risk factors and neighborhoods were not randomly assigned. Thus, directionality for significant findings could not be determined conclusively, and neighborhood groups could not be matched for race. Furthermore, because of this study's correlational design, selection bias (i.e., the tendency for non-deviant families to self-select into more prosperous neighborhoods) could not be ruled out.

Despite these limitations, this study helps shed light on why children from poor neighborhoods are at increased risk for CP, helps clarify how children's CP and neighborhood

experiences relate, and improves our understanding of how community context affects the association between CP and its risk factors. In the future, it will be important to examine whether these findings replicate with larger and more diverse samples. In addition, it will be important to examine how protective factors affect children from diverse contexts as the social push theory may have relevance for explaining resilience as well as maladjustment.

Acknowledgements This research was supported by NIMH grant, 5R01MH050907-13, awarded to the second author, which provided for data collection, and NIMH grant, T32 MH015169, awarded to the first author. The authors would like to thank Bobby Jones at Carnegie Mellon University, who assisted with data analysis.

References

- Achenbach, T. M. (1991). *Manual for the child behavior checklist/4-18 and 1991 profiles*. Burlington: University of Vermont, Department of Psychiatry.
- Achenbach, T. M. (1992). *Manual for the child behavior checklist 2/3 and 1992 profile*. Burlington: University of Vermont, Department of Psychiatry.
- Bavlovek, S. J., Kline, D. F., McLaughlin, J. A., & Publicover, P. R. (1977). *The development of the adolescent parenting inventory: Identification of high risk adolescents prior to parenthood*. Logan, UT: Utah State University.
- Beale-Spencer, M., Cole, S. P., Jones, S. M., & Swanson, D. P. (1997). Neighborhood and family influences on young urban adolescents' behavior problems: A multisample, multisite analysis. In J. Brooks-Gunn, G. Duncan, & L. Aber (Eds.), *Neighborhood poverty*, vol. 1, (pp.164–180). NY: Russell Sage.
- Beck, A. T., Ward, C. H., Mendelson, M., Mock, J. E., & Erbaugh, J. K. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, 4, 561–571.
- Bergman, L. R., & Magnusson, D. (1997). A person-oriented approach in research on developmental psychopathology. *Development and Psychopathology*, 9, 291–319.
- Beyers, J. M., Bates, J. E., Pettit, G. S., & Dodge, K. A. (2003). Neighborhood structure, parenting processes, and the development of youths' externalizing behaviors: A multilevel analysis. *American Journal of Community Psychology*, 31, 35–53.
- Beyers, J. M., Loeber, R., Wikström, P. H., & Stouthamer-Loeber, M. (2001). What predicts adolescent violence in better-off neighborhoods. *Journal of Abnormal Child Psychology*, 29, 369–381.
- Biederman, J., & Faraone, S. V. (2002). Current concepts on the neurobiology of attention-deficit/hyperactivity disorder. *Journal of Attention Disorders*, 6(Suppl), S7–S16.
- Brame, B., Nagin, D.S., & Tremblay, R. E. (2001). Developmental trajectories of physical aggression from school entry to late adolescence. *Journal of Child Psychology and Psychiatry*, 42, 503–512.
- Brody, G. H., Ge, X., Conger, R., Gibbons, F. X., McBride Murry, V., Gerrard, M., et al. (2001). The influence of neighborhood disadvantage, collective socialization, and parenting on African American children's affiliation with deviant peers. *Child Development*, 72, 1231–1246.
- Bursik, R. J. (1988). Social disorganization and theories of crime and delinquency: Problems and prospects. *Criminology*, 26, 519–551.
- Caldwell, B. M., & Bradley, R. H. (1984). *Home Observation for Measurement of the Environment*. Little Rock: University of Arkansas at Little Rock.
- Dabbs, J. M., Jr., & Morris, R. (1990). Testosterone, social class, and antisocial behavior in a sample of 4,462 men. *Psychological Science*, 1, 209–211.
- Davila, J., Karney, B. R., Hall, T. W., & Bradbury, T. N. (2003). Depressive symptoms and marital satisfaction: Within-subjects associations and the moderating effects of gender and neuroticism. *Journal of Family Psychology*, 17, 557–570.
- Derogatis, L. R., & Cleary, P. A. (1977). Confirmation of the dimensional structure of the SCL-90: A study in construct validation. *Journal of Clinical Psychology*, 38, 981–989.
- Dubow, E. F., Edwards, S., & Ippolito, M. F. (1997). Life stressors, neighborhood disadvantage, and resources: A focus on inner-city children's adjustment. *Journal of Clinical Child Psychology*, 26, 130–144.
- Eamon, M. K. (2001). Poverty, parenting, peer and neighborhood influences on young adolescent antisocial behavior. *Journal of Social Service Research*, 28, 1–23.
- Eggleston, E. P., Laub, J. H., & Sampson, R. J. (2004). Methodological sensitivities to latent class analysis of long-term criminal trajectories. *Journal of Quantitative Criminology*, 20, 1–26.
- Farrington, D. P. (1997). The relationship between low resting heart rate and violence. In A. E. Raine, P. A. Brennan, D. P. Farrington, & S. A. Mednick (Eds.), *Biosocial bases of violence* (pp. 89–105). New York: Plenum.
- Gorman-Smith, D., & Tolan, P. (1998). The role of exposure to community violence and developmental problems among inner-city youth. *Development and Psychopathology*, 10, 101–116.
- Gorman-Smith, D., Tolan, P. H., & Henry, D. (1999). The relation of community and family to risk among urban-poor adolescents. In P. Cohen, C. Slomkowski, & L. N. Robins (Ed.), *Historical and geographical influences on psychopathology*. (pp. 349–367). Mahwah, NJ: Lawrence Erlbaum.
- Gorman-Smith, D., Tolan, P. H., & Henry, D. B. (2000). A developmental-ecological model of the relation of family functioning to patterns of delinquency. *Journal of Quantitative Criminology*, 16, 169–198.
- Hoffman, J. P. (2003). A contextual analysis of differential association, social control, and strain theories of delinquency. *Social Forces*, 81, 753–785.
- Ingoldsby, E. M., & Shaw, D. S. (2002). Neighborhood contextual factors and early-starting antisocial pathways. *Clinical Child and Family Psychology Review*, 5, 21–55.
- Kagan, J. (1997). Temperament and reactions to unfamiliarity. *Child Development*, 68, 139–143.
- Kagan, J. (1998). Biology and the child. In W. Damon (Series Ed.), & N. Eisenberg (Vol Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (5th ed., pp 177–235). Hoboken, NJ: John Wiley & Sons.
- Kim-Cohen, J., Moffitt, T. E., Taylor, A., Pawlby, S. J., & Caspi, A. (2005). Maternal depression and children's antisocial behavior: Nature and nurture effects. *Archives of General Psychiatry*, 62, 173–181.
- Korenman, S., Miller, J., & Sjaastad, J. (1995). Long-term poverty and child development in the United States: Results from the NLSY. *Children and Youth Services Review*, 17, 127–155.
- Kupersmidt, J. B., Griesler, P. C., DeRosier, M. E., Patterson, C. J., & Davis, P. W. (1995). Childhood aggression and peer relations in the context of family and neighborhood factors. *Child Development*, 66, 360–375.
- Larzelere, R. E., Martin, J. A., & Amberson, T. G. (1989). The toddler behavior checklist: A parent-completed assessment of social-emotional characteristics of young preschoolers. *Family Relations*, 38, 415–425.

- Leventhal, T., & Brooks-Gunn, J. (2000). The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. *Psychological Bulletin*, *126*, 309–337.
- Lindstrom, P. (1996). Family interaction, neighborhood context and deviant behavior: A research note. *Studies on Crime and Crime Prevention*, *5*, 113–119.
- Loeber, R., Farrington, D. P., Stouthamer-Loeber, M., & Van Kammen, W. B. (1998). *Antisocial behavior and mental health problems: Explanatory factors in childhood and adolescence*. Mahwah, NJ: Lawrence Erlbaum.
- Loeber, R., & Stouthamer-Loeber, M. (1998). Development of juvenile aggression and violence: Some common misconceptions and controversies. *American Psychologist*, *53*, 242–259.
- Locke, H. J., & Wallace, K. M. (1959). Short marital-adjustment and prediction tests: Their reliability and validity. *Marriage and Family Living*, *21*, 251–255.
- Lynam, D. R., Caspi, A., Moffitt, T. E., Wikström, P. H., Loeber, R., & Novak, S. (2000). The interaction between impulsivity and neighborhood context on offending: The effects of impulsivity are stronger in poorer neighborhoods. *Journal of Abnormal Psychology*, *109*, 563–574.
- Massey, D. S., Gross, A. B., & Shibuya, K. (1994). Migration, segregation, and the geographic concentration of poverty. *American Sociological Review*, *52*, 425–445.
- McCord, J. (2000). Developmental trajectories and intentional actions. *Journal of Quantitative Criminology*, *16*, 237–253.
- McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist*, *53*, 185–204.
- McGue, M., & Christensen, K. (1997). Genetic and environmental contributions to depression symptomatology: Evidence from Danish twins 75 years of age and older. *Journal of Abnormal Psychology*, *106*, 439–448.
- Nagin, D. S. (2005). *Group-based modeling of development*. Cambridge, MA: Harvard University Press.
- Owens, E. B., Shaw, D. S., & Vondra, J. I. (1998). Relations between infant irritability and maternal responsiveness in low-income families. *Infant Behavior & Development*, *21*, 761–768.
- Orvaschel, H., & Puig-Antich, J. (1987). *Schedule for affective disorders and schizophrenia for school-age children: Epidemiologic 4th version*. Ft. Lauderdale, FL: Nova University, Center for Psychological Study.
- Patterson, G. R. (1982). *Coercive family process*. Eugene, OR: Castalia.
- Pettit, G. S., Bates, J. E., Dodge, K. A., & Meece, D. W. (1999). The impact of after-school peer contact on early adolescent externalizing problems is moderated by parental monitoring, perceived neighborhood safety, and prior adjustment. *Child Development*, *70*, 768–778.
- Plybon, L. E., & Kliever, W. (2001). Neighborhood types and externalizing behavior in urban school-age children: Tests of direct, mediated, and moderated effects. *Journal of Child and Family Studies*, *10*, 419–437.
- Raine, A., Reynolds, C., Venables, P. H., Mednick, S. A. (1997). Biosocial bases of aggressive behavior in childhood: Resting heart rate, skin conductance orienting, and physique. In A. E. Raine, P. A. Brennan, D. P. Farrington, & S. A. Mednick (Eds.), *Biosocial bases of violence* (pp. 107–126). New York: Plenum.
- Raine, A., & Venables, P. H. (1984). Tonic heart rate level, social class and antisocial behaviour in adolescents. *Biological Psychology*, *18*, 123–132.
- Rankin, B. H., & Quane, J. M. (2002). Social contexts and urban adolescent outcomes: The interrelated effects of neighborhoods, families, and peers on African-American youth. *Social Problems*, *49*, 79–100.
- Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel of collective efficacy. *Science*, *277*, 918–924.
- Sattler, J. M. (1992). *Assessment of children: WISC-III and WPPSI-R supplement*. San Diego, CA: Jerome M. Sattler.
- Seguin, J. R., Nagin, D., Assaad, J. M., & Tremblay, R. E. (2004). Cognitive-neuropsychological function in chronic physical aggression and hyperactivity. *Journal of Abnormal Psychology*, *113*, 603–613.
- Shaw, D. S., Criss, M., Schonberg, M. A., & Beck, J. E. (2004). Hierarchies and pathways leading to school-age conduct problems. *Development and Psychopathology*, *16*, 483–500.
- Shaw, D. S., Gilliom, M., Ingoldsby, E. M., & Nagin, D. (2003). Trajectories leading to school-age conduct problems. *Developmental Psychology*, *30*, 355–364.
- Shaw, D. S., Keenan, K., & Vondra, J. I. (1994). Developmental precursors of externalizing behavior: Ages 1 to 3. *Developmental Psychology*, *30*, 355–364.
- Simons, R. L., Lin, K., Gordon, L. C., Brody, G. H., & Conger, R. D. (2002). Community differences in the association between parenting practices and child conduct problems. *Journal of Marriage and Family*, *64*, 331–345.
- Tolan, P. H., Gorman-Smith, D., & Henry, D. B. (2003). The developmental ecology of urban males' youth violence. *Developmental Psychology*, *39*, 274–291.
- Turkenheimer, E., Haley, A., Waldron, M., D'Onofrio, B., & Gottesman, I. I. (2003). Socioeconomic status modifies heritability of IQ in young children. *Psychological Science*, *14*, 623–628.
- Wachs, T. D., & Bates, J. E. (2001). Temperament. In G. Bremner & A. Fogel (Eds.), *Blackwell handbook of infant development* (pp. 465–501). Malden, MA: Blackwell.
- Wechsler, D. (1989). *Wechsler preschool and primary scale of intelligence-revised*. San Antonio: The Psychological Corporation.
- Wikström, P. O., & Loeber, R. (2000). Do disadvantaged neighborhoods cause well-adjusted children to become adolescent delinquents? A study of male juvenile serious offending, individual risk and protective factors, and neighborhood context. *Criminology*, *38*, 1109–1142.
- Winslow, E. B., Shaw, D. S., Bruns, H., & Kiebler, K. (1995). Parenting as a mediator of child behavior problems and maternal stress, support, and adjustment. *Paper presented at the Biennial Meeting of the Society for Research in Child Development, Indianapolis, IN*.