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*Int J Offender Ther Comp Criminol* 2003; 47; 253
DOI: 10.1177/0306624X03047003002

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Cognitive Ability and Delinquent Behavior Among Inner-City Youth: A Life-Course Analysis of Main, Mediating, and Interaction Effects

Jean Marie McGloin
Travis C. Pratt

Abstract: Drawing on the emerging life-course paradigm in criminological theory, this study examines the relationship between cognitive ability and delinquent behavior within a sample of inner-city youth. The results indicate that net of statistical controls, cognitive ability maintains a robust inverse relationship with the likelihood of the onset of delinquency, the early onset of delinquency, and the persistence of delinquency during the 18-year period covered by the dataset. Furthermore, cognitive ability mediates the effect of concentrated disadvantage on both the onset and early onset of delinquency. Overall, the results of this study suggest that cognitive ability is an important criminogenic risk factor that has important implications for both correctional interventions and the continued development of structural and multilevel theories of crime.

Keywords: cognitive ability; delinquency; life-course criminology; concentrated disadvantage; neuropsychological deficit

The relationship between cognitive ability and crime/deviance has had a rather dubious history in criminological theory and research. Early positivist perspectives on the participant often viewed the relationship in terms of biological determinism (Dugdale, 1877) and were typically couched in the language of how genetically inferior parents would pass on to their offspring the genetic code that would make crime/deviance almost inevitable (see also Fishbein, 2001). Even so, the precise mechanism by which a deficiency in cognitive ability would lead to a higher likelihood of engaging in criminal and/or deviant behavior was still up for debate. Some scholars held that the relationship is indirect in that deficits in intellect may inhibit individuals’ understandings of right and wrong which would also lead some to unwittingly engage in crime—a more contemporary version of which has been articulated by Herrnstein and Murray (1994). On the other hand, others contended that the general lack of intelligence among the offender popula-
tion was de facto evidence of a direct link between cognitive ability and crime (Goddard, 1914). Regardless of their differences, each of these early perspectives shared the underlying premise that variations in individual-level factors (such as cognitive ability), not social conditions, were responsible for criminal behavior.

Social and economic changes in the United States beginning in the early 1900s, however, resulted in new social problems and new ways of thinking about the sources of criminal behavior. Rapid increases in urbanization, residential mobility, and the rise of racially heterogeneous neighborhoods in American cities seemed to occur in concert with increases in crime rates (Shaw & McKay, 1942; see also Pratt, Maahs, & Stehr, 1998). In particular, crime became visibly concentrated among the urban poor. In the midst of the Progressive movement—a liberal reform movement that originated in late 19th century America—criminologists began to reject the notion that the poor were somehow biologically inferior and that they therefore deserved their meager lot in life as the natural outcome of their collective intellectual shortcomings (Cullen & Gilbert, 1982). Instead, the Progressives took the position that impoverished citizens were pushed often by their environment, not born, into a life of crime (Lilly, Cullen, & Ball, 2002). As a consequence, a number of new formulations of criminological thought began to emerge that sought to shift the assumed “causes” of crime from the personal to the social plane (Matza, 1969).

As Bursik and Grasmick (1993) noted, however,

with the refinement of survey approaches to data collection and the increased interest in social-psychological theories of control, deterrence, learning, and labeling, the focus of the discipline significantly began to shift from group dynamics to individual processes during the 1960s and 1970s. (p. ix)

During this time, criminologists' interest in the link between cognitive ability and crime/deviance was again piqued by Hirschi and Hindelang’s (1977) review of the literature assessing the relationship between IQ and delinquency. One of the better known findings from Hirschi and Hindelang’s review is that delinquents and nondelinquents differed in their IQ by approximately one standard deviation. Given the magnitude of this difference, the authors concluded that the IQ/delinquency relationship was just as important as that between social class and delinquency.

There are, of course, dangers associated with focusing on cognitive ability to the complete exclusion of other criminogenic risk factors. Indeed, Herrnstein and Murray’s (1994) The Bell Curve was based on the rather bold and empirically uninformed proposition that individuals’ intelligence (measured as IQ) is the primary predictor of a whole host of social behaviors and outcomes. In particular, according to Herrnstein and Murray, persons with low intelligence are more likely to commit crime, to do poorly in school, to have difficulty finding gainful employment, to end up on welfare, to have children out of wedlock, and to generally be a drain on the commonweal of society. Fortunately, many of these claims have been
debunked, such as those that hold that IQ is the sole cause of delinquent behavior (Cullen, Gendreau, Jarjoura, & Wright, 1997), that cognitive ability is unequivocally unidimensional (Gardner, 1983; Gould, 1996), and that, over time, variations in individuals’ intelligence have been the driving force behind social change in the United States (Tittle & Rotolo, 2000).

Nevertheless, despite such disagreements concerning the relative effect of cognitive ability on crime/deviance (i.e., the magnitude of the relationship in comparison to other, perhaps stronger, criminogenic risk factors), there is still a sizeable body of empirical literature demonstrating that the two variables are, in fact, related (see, e.g., Denno, 1989; Moffitt, 1990). Furthermore, researchers have shown that a significant relationship between cognitive ability—at least when measured as IQ—and delinquency remains even when controlling for additional factors such as race and socioeconomic status (Moffitt, Gabrielli, & Mednick, 1981). Research has also revealed that the IQ/delinquency relationship holds up when predicting self-reported delinquency that was undetected by official channels, which generally renders the detection hypothesis, as a source of potential spuriousness, untenable (Moffitt & Silva, 1988).

Even so, considerable scholarly debate remains concerning why such a relationship should exist (Ward & Tittle, 1994). For example, some argue that cognitive ability and crime/deviance are related as a result of school performance, where low intelligence may lead to low academic achievement, which may, in turn, inhibit the formation of prosocial bonds to conventional institutions that may prevent delinquency (Hirschi, 1969; Menard & Morse, 1984). Others, however, view the relationship as one of school reaction, where low intelligence—again, upon leading to low academic achievement—could influence the direction of curriculum tracks in schools. As a consequence, being placed on a remedial curriculum track could influence youths’ levels of self-esteem and therefore increase the likelihood of delinquent behavior (Oaks, 1985; Polk, 1975; Polk & Schafer, 1972).

Although these debates are still ongoing, the emerging life-course perspective in criminological theory and research represents one potential avenue for organizing such divergent perspectives (see Elder, 1994; Sampson & Laub, 1993). To be sure, the relationship between cognitive ability and crime/deviance may take on different forms at different points throughout the life course and at different stages in an individual’s offending history (Huang, Kosterman, Catalano, Hawkins, & Abbott, 2001), which may partially explain the heterogeneity in research findings within this body of literature. Although the life-course perspective may help to clarify such theoretical debates, another potential contributor to the inconsistency in the research in this area may be criminologists’ overreliance on IQ as a measure of cognitive ability. Indeed, researchers have long questioned the reliability and validity of IQ measures as a proxy for cognitive ability, especially when applied to samples drawn from economically disadvantaged minority communities (Gould, 1996).
RESEARCH STRATEGY

Accordingly, the present study seeks to reassess the link between cognitive ability and delinquent behavior on a sample of urban, Black youths drawn from economically disadvantaged social environments. In doing so, we employ an alternative measure of cognitive ability (as opposed to IQ): youths’ performance on the California Achievement Test (CAT)—a measure that has recently been introduced in the criminological literature (Ge, Donnellan, & Wenk, 2001). Furthermore, drawing on the life-course perspective, we examine the effect of cognitive ability on three separate delinquency measures that reflect different stages of offending: (a) the activation—or onset—of offending, (b) the early onset of offending, and (c) the persistence of offending. Also consistent with the life-course perspective, we explore whether, in addition to exerting a direct effect on the three delinquency-outcome measures, cognitive ability: (a) mediates the effects of other biosocial characteristics (gender and neuropsychological deficit) and/or social-structural conditions (concentrated disadvantage) on delinquency, and (b) whether cognitive ability maintains significant interaction effects with such characteristics on delinquency. In the end, the broader aim of this study is to uncover whether—and perhaps under what conditions—criminologists should continue to focus on cognitive ability as a substantively important criminogenic risk factor.

METHODS

Data Sources and Sample

The data used in this study were obtained from the Inter-University Consortium for Political and Social Research and are part of the Longitudinal Study of Biosocial Factors Related to Crime and Delinquency in Pennsylvania (Denno, 1990). Data for this larger project came from three sources: The Collaborative Perinatal Project (CPP), data from the Philadelphia public school system, and data from the Philadelphia Police Department. The CPP, which was initiated in 1959, was a large-scale medical project aimed at gathering baseline information on birth defects. It included measures such as the biological history of the mother, the progress of the pregnancy, the nature of the birth, and familial characteristics. Participants in the CPP included families (women in particular) who were interested in receiving maternity care from a public hospital in Philadelphia. Additional CPP measures prospectively follow the children of such families from birth to the age of 7.

From the 2,958 Black mothers who participated in the first four cohorts of the CPP (1959-1962), Denno (1990) selected 987 youths as her participants, all of whom met certain criteria: (a) his or her mother was Black, (b) he or she attended a public school in Philadelphia, (c) he or she lived in Philadelphia from the age of 10
to 17, (d) he or she did not have a sibling that had been excluded from the sample, and (e) he or she underwent intelligence testing at the ages of 7 and 14. Denno (1990) reported that these participants did not significantly differ from the remaining 1,971 individuals with regard to any important variables.¹ Once the selection of the 987 youths was completed, Denno gathered data from the Philadelphia public school system (from age 7 to 14) and the Philadelphia Police Department (from age 7 to 18). The data on the participants in the study include information on the youths’ social environment, their cognitive ability, their health, and their delinquent career (including activation, time of onset, and persistence).

The external validity of this study is therefore limited by race, class, history, and locale. The entire sample consists of Black, inner-city youths from Philadelphia who grew up decades ago, and generalizing the results of the present study to dissimilar populations would therefore be inappropriate. The results of this study should therefore be viewed as adding primarily to the body of scholarship addressing criminal/delinquent behavior among minority youths in an inner-city urban context (Anderson, 1999; Dembo, 1988; Jankowski, 1991; Sampson, 1987; Sampson & Wilson, 1995; Wilson, 1987, 1996). Even so, scholars have argued that relatively homogeneous samples such as this are well suited for criminological research because inner-city Black youth are at a disproportionately high risk for exhibiting delinquent behavior (Elliott & Ageton, 1980; Sampson & Wilson, 1995). Perhaps most important, the longitudinal nature of the data affords us the opportunity to assess key theoretical relationships over time, which may yield more firm conclusions about potentially causal relationships.

**Dependent Variables**

As stated above, this study assesses three different dependent variables to reflect different offending patterns during the life course. The onset of offending variable measures whether the participant has, in fact, engaged in delinquent behavior. Of those who have offended, the early onset variable measures whether the participant began his or her delinquent career before the age of 14. Finally, the persistence of offending variable measures whether the participant has more than one official record of a delinquent act.²

**Onset of offending.** Data for this variable were taken from the Philadelphia Police Department. This variable measures whether each participant had contact with the police that resulted in either an official arrest or a remedial disposition. Values were coded dichotomously as 0 = no and 1 = yes.

**Early onset of offending.** Of the 987 youths in the sample, 220 illustrated onset of offending. For these cases, the age of onset ranged from age 8 to 18. Although there is no consensus regarding what age constitutes early onset, there is an established precedent of using the age of 14 as the cutoff point (Moffitt, Lynam, & Silva, 1994; Tibbetts & Piquero, 1999). There is also evidence to suggest that the
hazard rate for activation of offending is highest before the age of 14 (Blumstein, Cohen, Roth, & Visher, 1986). For the present analysis, early onset was recoded as 1 if the age of onset was younger than the age of 14, and as 0 if onset was at or older than the age of 14.

Persistence of offending. The number of official contacts with the police for youths in this sample ranged from 0 to 21. The distribution of this variable was highly positively skewed with the majority of individuals having one contact and then a precipitous drop-off as the number of contacts increased. Consistent with the measurement strategy of the two previous dependent variables, this variable was recoded as a dichotomy, with 1 indicating persistence (having 2 or more official contacts) and 0 indicating no persistence.

Independent Variables

Cognitive ability. While in the seventh grade, all of the 987 youths were administered the CAT. This multiple-choice test, designed by Tiegs and Clark (1951), was initially intended for California schools to use as a tool for measuring students’ academic achievement. Its use had spread to other states, including Pennsylvania, during the time of data collection. The CAT covers a variety of domains, including language skills, mathematics, reading, and spelling. Although scores are issued for each domain, this study uses the overall battery score. The score ranges from 0 to 99, with the values representing the percentile ranking. Thus, higher scores are assumed to indicate higher levels of cognitive ability.

Neuropsychological deficit. Moffitt’s (1993) developmental theory is the recent driving force behind the focus on neuropsychological deficit. A deficit in the central nervous system is proposed to be a product of some ontogenetic disturbance of the fetal brain, which can be caused by various prenatal risk factors such as maternal drug abuse, exposure to toxins, and poor nutrition (Moffitt, 1993). Lynam, Moffitt, and Stouthamer-Loeber (1993) suggested that deficits in the neuropsychological abilities referred to as “executive functions” interfere with a person’s ability to monitor and control his or her own behavior. . . . Theoretically, executive dysfunction will produce an inattentive, impulsive child who is handicapped at considering the future implications of his or her acts. (p. 188)

In short, the hypothesis is that congenital—therefore biological—risks produce neuropsychological deficits, which manifest behaviorally in a bad temperament. This “difficult child” engages in an evocative, detrimental, interactive cycle with his or her parents (who are likely players in a larger disadvantaged environment), which ultimately narrows prosocial opportunities and sets the child on a path toward the early onset of serious, stable antisocial behavior (Moffitt, 1993).
Although multiple measures of neuropsychological dysfunction exist (e.g., failure to thrive), this study uses low birth weight as a proxy for neuropsychological deficit for two reasons. First, low birth weight has been well established as an indicator of various adverse neurological outcomes in later life. Such outcomes include attention deficits, difficult temperament, developmental delay (psychological and physical), sensory impediments, psychiatric anomalies, central nervous system deficiencies, and other detrimental physical and psychological outcomes (Brennan & Mednick, 1997; Chess and Thomas, 1987; Coren, 1993; Denno, 1990; Hack et al., 1994). Second, with regard to the criminological literature, Tibbetts and Piquero (1999) have recently used this measure as a proxy for neuropsychological deficit in their respective analysis of the same data set.

Although neuropsychological deficit is essentially a biological risk factor that is proposed to manifest itself in fairly vivid behavioral problems (Moffitt, 1993), it would be naïve to ignore the fact that it may be related to cognitive ability. In particular, if one has very severe neuropsychological deficits, then he or she may be physically incapable of achieving in any manner in a cognitive sphere. Even if the deficit is less drastic, behavioral problems may impede cognitive development if parents and teachers exacerbate such behavior by not adequately stimulating and/or socializing the child during his or her early years. It is for these reasons that neurological deficit is included in this study of the effect of cognitive ability on delinquency.

Each child in the sample was weighed upon birth by staff in a Philadelphia public hospital. Weights ranged from 3 to 12 pounds. For the purposes of this study, the variable was recoded so that 1 indicated low birth weight (under 6 pounds) and 0 indicated normal birth weight (a similar approach was taken by Tibbetts and Piquero, 1999). Some may question whether a weight under 6 pounds is actually a valid operationalization of low birth weight. If these data were collected today, given advances in neonatology, the answer would certainly be that it is not. Nevertheless, the operationalization must be embedded in the context of the time of collection—in the 1950s, such medical advances did not exist. In fact, in 1950 the World Health Organization adopted this cutoff as appropriate for a universal definition of low birth weight.

Concentrated disadvantage. Concentrated disadvantage is typically conceived as consisting of multiple factors, including the concentration of adversity and family disruption within particular racial/ethnic groups (Sampson & Jeglum-Bartusch, 1998; Wilson, 1987). Because this sample consists of Black youths, therefore controlling for race, we chose two factors that measure economic disadvantage and family disruption: the income of the head of the household, and with whom does the child live. The living situation of the child was coded so that living with two parents (even if one was a stepparent) received a value of 2, living with one biological parent received a value of 1, and living with other relatives, in a foster home, with adoptive parents, or another situation received a value of 0. The
standardized scores for both variables were summed and averaged for each case. We then multiplied these values by –1 so that high scores on the variable indicate higher levels of concentrated disadvantage.

**Sex.** Whereas girls and women have a tendency to develop internalizing disorders such as depression and eating disorders, boys and men tend to be at greater risk for developing externalizing behavior disorders such as attention deficit and hyperactivity disorder and conduct disorder (Gaub & Carlson, 1997). Logically, therefore, boys and men are also at greater risk for illustrating criminal behavior than are women (Chesney-Lind & Sheldon, 1998; Tracy, Wolfgang, & Figlio, 1990). Although cognitive ability may have a main effect on delinquent behavior, it may also be mediated by a variety of psychological and social processes (Moffitt, 1990). The gender differential in engagement in criminal behavior, although not fully understood, may be due to psychological and/or social mechanisms. Accordingly, an understanding of how such processes may interact in different ways for males and females during the developmental processes would enhance our understanding of the influence that cognitive ability has on the criminal career. Therefore, in the present analysis we incorporate gender as both a control variable and as part of an interaction term with cognitive ability. Male is coded as 1 and female is coded as 0.

**Analytic Strategy**

The analysis focuses on testing for possible main, mediating, and interaction effects of cognitive ability on various stages of the criminal career. Because the dependent variables were all dichotomous, the multivariate models were estimated using logistic regression analysis techniques (Menard, 1995). For each dependent variable (the analyses for which are presented in Tables 2, 3, and 4), the 1st model includes low birth weight, concentrated disadvantage, and sex as predictors. The 2nd model includes cognitive ability as a predictor to determine whether it (a) has a main effect on the dependent variable of interest and (b) whether it mediates the effect of the other three predictors. In other words, in addition to the potential direct effect of cognitive ability on delinquency, specific attention will be paid to the degree to which the strength and/or significance of low birth weight, concentrated disadvantage, and sex are diminished upon including a measure of cognitive ability in the multivariate models.

Models 3, 4, and 5 test whether cognitive ability significantly interacts with low birth weight, concentrated disadvantage, or gender by systematically, and independently, adding interaction terms to the prediction model. In short, these models are intended to uncover, in addition to the independent effects of each predictor variable on delinquency, whether the effect of cognitive ability on delinquency is significantly greater for those with high levels of neuropsychological deficit, for those living in social conditions characterized by high levels of concentrated disadvantage, and for males.
RESULTS

Table 1 contains the descriptive statistics for the variables included in the multivariate models. As indicated, 22.3% of the participants in the sample exhibited the onset of offending. Of this group, 45.5% fell into the early onset category and 47.7% exhibited persistence of offending. The sample is fairly even with regard to the gender breakdown (49.3% male), and most youths did not suffer from neuropsychological deficits (20.9% were coded as having low birth weight). Furthermore, despite the existence of little variation on the concentrated disadvantage index—again, because most youths in the sample were drawn from disadvantaged social environments—and a relatively low mean score on the CAT (27.220 out of a possible 99), the majority of the youths in the sample did not engage in delinquent behavior.

Onset of Offending

Table 2 presents the results for the five logistic regression models predicting the onset of offending. Model 2 addresses the question of whether cognitive ability has a direct effect on the onset of delinquent behavior and whether it mediates the effects of the variables included in Model 1. The analysis reveals that cognitive ability does have a direct, robust, and inverse effect on the onset of delinquency. It also appears to dampen the effects of concentrated disadvantage on the onset of offending from Model 1 to Model 2. Furthermore, Model 3 reveals that upon the addition of the concentrated disadvantage-cognitive ability interaction term, the statistical significance of the concentrated disadvantage variable disappears.
These results suggest that, in addition to maintaining a direct effect on the likelihood of engaging in delinquent behavior, cognitive ability partially mediates the effect of concentrated disadvantage on the onset of delinquency. A similar pattern does not emerge, however, with the other control variables. To be sure, low birth weight is not a significant predictor of the onset of delinquency in any of the models, and sex was a strong and significant predictor of the onset of delinquency in each of the five multivariate models. Cognitive ability does not, therefore, mediate the effects of either neuropsychological deficit or sex on the likelihood of youths’ onset of delinquent behavior.

Models 3, 4, and 5 contain the results of the models where separate interaction terms were constructed between cognitive ability and the three control variables. In particular, Model 3 includes an interaction term between cognitive ability and concentrated disadvantage, Model 4 includes an interaction term between cognitive ability and sex, and Model 5 includes an interaction term between cognitive ability and low birth weight. As indicated by each of these models, no statistically significant interaction effects emerge when predicting to the onset of offending.

**TABLE 2**

LOGIT COEFFICIENTS AND STANDARD ERRORS FOR THE LOGISTIC REGRESSION MODELS PREDICTING THE ONSET OF OFFENDING (*n* = 987)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low birth weight</td>
<td>.303</td>
<td>.269</td>
<td>.278</td>
<td>.253</td>
<td>.287</td>
</tr>
<tr>
<td></td>
<td>(.190)</td>
<td>(.192)</td>
<td>(.193)</td>
<td>(.193)</td>
<td>(.281)</td>
</tr>
<tr>
<td>Concentrated disadvantage</td>
<td>.281**</td>
<td>.242*</td>
<td>.172</td>
<td>.234*</td>
<td>.241*</td>
</tr>
<tr>
<td></td>
<td>(.092)</td>
<td>(.094)</td>
<td>(.137)</td>
<td>(.094)</td>
<td>(.094)</td>
</tr>
<tr>
<td>Sex</td>
<td>1.078***</td>
<td>1.002***</td>
<td>.997***</td>
<td>.720**</td>
<td>1.003***</td>
</tr>
<tr>
<td></td>
<td>(.165)</td>
<td>(.167)</td>
<td>(.167)</td>
<td>(.246)</td>
<td>(.167)</td>
</tr>
<tr>
<td>Cognitive ability</td>
<td>–.014***</td>
<td>–.015***</td>
<td>–.023**</td>
<td>–.014**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.004)</td>
<td>(.004)</td>
<td>(.007)</td>
<td>(.004)</td>
<td></td>
</tr>
<tr>
<td>Concentrated disadvantage × cognitive ability</td>
<td>.003</td>
<td>.013</td>
<td>.003</td>
<td>.013</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.005)</td>
<td>(.008)</td>
<td>(.005)</td>
<td>(.008)</td>
<td></td>
</tr>
<tr>
<td>Sex × cognitive ability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low birth weight × cognitive ability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>–.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.100)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>–2 log likelihood</td>
<td>991.523***</td>
<td>976.161***</td>
<td>975.674***</td>
<td>973.756***</td>
<td>976.154***</td>
</tr>
<tr>
<td><em>(n = 986)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>.083</td>
<td>.106</td>
<td>.106</td>
<td>.109</td>
<td>.106</td>
</tr>
</tbody>
</table>

*p < .05. **p < .01. ***p < .001.*

These results suggest that, in addition to maintaining a direct effect on the likelihood of engaging in delinquent behavior, cognitive ability partially mediates the effect of concentrated disadvantage on the onset of delinquency.

A similar pattern does not emerge, however, with the other control variables. To be sure, low birth weight is not a significant predictor of the onset of delinquency in any of the models, and sex was a strong and significant predictor of the onset of delinquency in each of the five multivariate models. Cognitive ability does not, therefore, mediate the effects of either neuropsychological deficit or sex on the likelihood of youths’ onset of delinquent behavior.

Models 3, 4, and 5 contain the results of the models where separate interaction terms were constructed between cognitive ability and the three control variables. In particular, Model 3 includes an interaction term between cognitive ability and concentrated disadvantage, Model 4 includes an interaction term between cognitive ability and sex, and Model 5 includes an interaction term between cognitive ability and low birth weight. As indicated by each of these models, no statistically significant interaction effects emerge when predicting to the onset of offending.
Early Onset of Offending

Of the participants that did exhibit the onset of offending \((n = 220)\), Table 3 presents the results for the logistic regression models predicting the early onset of offending. As with the previous set of analyses, Model 2 addresses the questions of whether cognitive ability has a direct effect on the early onset of delinquent behavior and whether it mediates the effects of the variables included in Model 1. These analyses reveal that cognitive ability does have a direct, robust (in fact, the most robust) effect on the early onset of delinquency, where cognitive ability maintains a statistically significant inverse effect on the early onset of delinquency for all models except Model 4. Model 2 also reveals that cognitive ability fully mediates the effect of concentrated disadvantage on the early onset of offending.

Like the models predicting the onset of offending, however, cognitive ability does not mediate the effects of any of the other control variables on the early onset of offending. Indeed, low birth weight maintains a statistically significant positive relationship with the early onset of delinquency in each of the models except Model 5, where the interaction term between cognitive ability and low birth weight is included in the multivariate model. Sex, on the other hand, is unrelated to the early onset of delinquency in each of the five models in Table 3. Also consistent with the analyses predicting the onset of offending, no interaction effects emerge as statistically significant when predicting the likelihood of early onset of offending.

Persistence of Offending

Table 4 displays the results of the five logistic regression models predicting the persistence of offending using the same subset of the sample as the models presented in Table 3 \((n = 220)\). Model 2 again addresses the questions of whether cognitive ability has a direct effect on the persistence of delinquent behavior and whether it mediates the effects of the predictors included in Model 1. The analysis reveals that cognitive ability does have a direct, robust (again, the most robust) inverse effect on the likelihood of persistence of delinquent behavior. Model 2 does not reveal any mediating effects on the persistence of delinquency because the pattern of statistically significant predictors does not change; sex is the only other significant predictor of the persistence of offending, and its effects are not diminished when cognitive ability is included in the multivariate models. Models 3, 4, and 5 address the third analytical question of interest—whether any interaction effects exist between cognitive ability and the other independent variables on the persistence of delinquency. None of the interaction terms emerge as statistically significant, suggesting that cognitive ability has only direct effects when predicting the persistence of delinquent behavior.
Statistical Diagnostic Procedures

The results of the analyses presented in Tables 2, 3, and 4 require further examination given the potential problem of causal ordering between our measure of cognitive ability and each of the three dependent variables we assessed. In particular, because the CAT was administered to the participants in the sample at some point in the seventh grade (between the ages of 12 and 13), certain youths exhibited delinquent behavior prior to having been scored on the CAT. Specifically, 3.7% of the sample offended before the age of 12 and 6.5% of the sample offended before the age of 13. To examine the degree to which the results presented in Table 3 were influenced by this potential bias, we reestimated each of the models after deleting these youths from the analyses (with separate analyses for those who offended before ages 12 vs. 13).

Upon doing so, for the onset of delinquency the direct effect of concentrated disadvantage was eliminated for the models excluding those who offended prior to the age of 13 only. In the models predicting the early onset of delinquency, concentrated disadvantage failed to exhibit any direct effects when excluding from

### TABLE 3
LOGIT COEFFICIENTS AND STANDARD ERRORS FOR THE LOGISTIC REGRESSION MODELS PREDICTING THE EARLY ONSET OF OFFENDING \((n = 220)\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low birth weight</td>
<td>.709*</td>
<td>.707*</td>
<td>.717*</td>
<td>.711*</td>
<td>.675</td>
</tr>
<tr>
<td></td>
<td>(.330)</td>
<td>(.337)</td>
<td>(.339)</td>
<td>(.337)</td>
<td>(.482)</td>
</tr>
<tr>
<td>Concentrated disadvantage</td>
<td>.324*</td>
<td>.308</td>
<td>.257</td>
<td>.312</td>
<td>.310</td>
</tr>
<tr>
<td></td>
<td>(.159)</td>
<td>(.162)</td>
<td>(.237)</td>
<td>(.162)</td>
<td>(.163)</td>
</tr>
<tr>
<td>Sex</td>
<td>.198</td>
<td>.192</td>
<td>.185</td>
<td>.280</td>
<td>.191</td>
</tr>
<tr>
<td></td>
<td>(.304)</td>
<td>(.310)</td>
<td>(.311)</td>
<td>(.447)</td>
<td>(.310)</td>
</tr>
<tr>
<td>Cognitive ability</td>
<td>–.020**</td>
<td>–.021**</td>
<td>–.017</td>
<td>–.021*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.008)</td>
<td>(.008)</td>
<td>(.014)</td>
<td>(.009)</td>
<td></td>
</tr>
<tr>
<td>Concentrated disadvantage × cognitive ability</td>
<td>0.003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.009)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex × cognitive ability</td>
<td>–.005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.017)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low birth weight × cognitive ability</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.018)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-2) log likelihood ((n = 220))</td>
<td>294.031*</td>
<td>286.064**</td>
<td>285.975**</td>
<td>285.989**</td>
<td>286.056**</td>
</tr>
<tr>
<td>Pseudo (R^2)</td>
<td>.054</td>
<td>.100</td>
<td>.100</td>
<td>.100</td>
<td>.100</td>
</tr>
</tbody>
</table>

\(*p < .05. \,**p < .01.\)
the analyses those who offended prior to the age of either 12 or 13. Thus, in these cases there was no effect of concentrated disadvantage on either the onset or early onset of delinquency for cognitive ability to mediate. As stated above, part of the problem in this context is the relative lack of variation on the concentrated disadvantage index for the participants in the present sample. In purely statistical terms, the lack of variation in the independent variable (in this case, concentrated disadvantage) makes it more difficult to “explain” variation in any given dependent variable (Hanushek & Jackson, 1977).

Nevertheless, the direct effect of cognitive ability on all three dependent variables across all 12 models remained the same regardless of which participants were included or excluded from the analyses. Overall, despite a few differences, the general pattern of statistical significance/nonsignificance remained the same for the relationships reassessed in these additional models. We are therefore confident that the results presented in Tables 2, 3, and 4 accurately reflect ongoing patterns in the dataset with regard to cognitive ability and delinquency and are not an artifact of a causal ordering problem contained in a small portion of the youths in the sample.

**TABLE 4**

LOGIT COEFFICIENTS AND STANDARD ERRORS FOR THE LOGISTIC REGRESSION MODELS PREDICTING THE PERSISTENCE OF OFFENDING \((n = 220)\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low birth weight</td>
<td>-.271</td>
<td>-.319</td>
<td>-.339</td>
<td>-.315</td>
<td>-.031</td>
</tr>
<tr>
<td></td>
<td>(.331)</td>
<td>(.339)</td>
<td>(.340)</td>
<td>(.339)</td>
<td>(.492)</td>
</tr>
<tr>
<td>Concentrated disadvantage</td>
<td>.147</td>
<td>.132</td>
<td>.236</td>
<td>.134</td>
<td>.119</td>
</tr>
<tr>
<td></td>
<td>(.158)</td>
<td>(.162)</td>
<td>(.238)</td>
<td>(.163)</td>
<td>(.163)</td>
</tr>
<tr>
<td>Sex</td>
<td>.794*</td>
<td>.823**</td>
<td>.838**</td>
<td>.878</td>
<td>.839**</td>
</tr>
<tr>
<td></td>
<td>(.308)</td>
<td>(.315)</td>
<td>(.317)</td>
<td>(.453)</td>
<td>(.317)</td>
</tr>
<tr>
<td>Cognitive ability</td>
<td>-.024**</td>
<td>-.023**</td>
<td>-.022</td>
<td>-.021*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.008)</td>
<td>(.008)</td>
<td>(.016)</td>
<td>(.008)</td>
<td></td>
</tr>
<tr>
<td>Concentrated disadvantage × cognitive ability</td>
<td>-.005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.009)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex × cognitive ability</td>
<td>-.003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.018)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low birth weight × cognitive ability</td>
<td></td>
<td></td>
<td></td>
<td>-.017</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(.022)</td>
<td></td>
</tr>
<tr>
<td>–2 log likelihood</td>
<td>293.407*</td>
<td>282.386**</td>
<td>282.022**</td>
<td>282.357**</td>
<td>281.716**</td>
</tr>
<tr>
<td>((n = 218))</td>
<td>.050</td>
<td>.113</td>
<td>.115</td>
<td>.114</td>
<td>.117</td>
</tr>
</tbody>
</table>

*p < .05. **p < .01.
DISCUSSION

Theoretical discussions regarding the presumed causes of crime often overlook or dismiss certain empirical relationships for a number of reasons. For example, the validity of a particular empirical relationship may be either embraced or rejected by the academic community depending upon: (a) whether the idea proves to be interesting and/or contrary to common sense (Hagan, 1973), (b) whether the specified relationship can be readily translated into operational concepts that can be easily researched and expediently result in publications (Cole, 1975), (c) whether the policy implications of the relationship are either favorable or disquieting (Gould, 1996), and (d) the degree to which the validity of the relationship coincides with the broader social context in which scholars are working (Lilly et al., 2002). Unfortunately, all too often the empirical validity of a relationship—as established across empirical studies—takes a backseat to these more subjective and fluid criteria (see, e.g., the discussion by Pratt & Cullen, 2000). The relationship between cognitive ability and delinquency is certainly no exception.

Indeed, disputes regarding whether the relationship exists, why it should or should not exist, how strong the link should be, and what the causal processes are that should lead lower levels of cognitive ability to increase the likelihood of delinquency have been ongoing for a number of years. Although it was not the aim of the present study to settle these debates, the work presented here does add to the growing roster of studies that indicate that cognitive ability is a substantively important predictor of delinquent behavior. In demonstrating this link, however, four issues deserve elaboration.

First, although our study does indicate that cognitive ability is a substantively important predictor of delinquency, we hasten to note that we are making no claim that it should be viewed as the sole predictor of such behavior. Indeed, unlike Herrnstein and Murray (1994), we see cognitive ability as being both conceptually and empirically important to a full explanation of delinquency when considered in the context of other predictors of wayward behavior. To be sure, cognitive ability should be considered an important criminogenic risk factor in conjunction with other well-established individual-level predictors of crime and deviance, such as peer effects (Warr & Stafford, 1991), antisocial attitudes (Akers, 1998; Andrews & Bonta, 1998), and variables indicating antisocial personality/self-control (Pratt & Cullen, 2000).

Second, also unlike Herrnstein and Murray (1994), we do not regard the relationship between cognitive ability and delinquency as deterministic. As opposed to viewing cognitive ability as fully genetic in origin, fixed at birth, and immutable during the life course, we concur with researchers who advance the more optimistic (and empirically viable) position that cognitive ability is a dynamic and malleable individual-level characteristic (Furnham, 2001; Gould, 1996). Thus, behavioral interventions (e.g., correctional interventions) could target cognitive ability as a risk factor for change. Perhaps even more important, we echo the position of Cullen et al. (1997) that cognitive ability may be even more relevant as a
responsivity factor for correctional interventions. According to Andrews and Bonta (1998), in the context of the factors that may influence the level of success achieved by a correctional intervention, the responsivity principle holds that correctional services intended to reduce recidivism will be most effective when the services are delivered in a manner that is consistent with offenders’ learning styles and abilities. Should at-risk youths’ cognitive ability be enhanced, therefore, traditional cognitive/behavioral-based correctional programs—which have been shown to be quite effective with offenders generally (Andrews et al., 1990)—may achieve an even higher level of success with youthful offenders.

The third important issue is that cognitive ability appears to be able to mediate the criminogenic effects of concentrated disadvantage on delinquent behavior. Indeed, cognitive ability fully mediated the effect of concentrated disadvantage on the early onset of offending. Although cognitive ability did not consistently cause the effects of concentrated disadvantage to wash out in the remaining models, the effects of concentrated disadvantage were dampened after controlling for cognitive ability when predicting the onset of delinquency (see Table 5 for a summary). At minimum, these findings have important implications for structural and multilevel theories of crime (see, e.g., Agnew, 1999; Sampson & Groves, 1989; Sampson, Raudenbush, & Earls, 1997) in that future studies may wish to incorporate the effects of cognitive ability as an individual-level factor into existing theoretical models.

Finally, our analysis indicates that cognitive ability influences delinquency differently at different stages during an individual’s offending history. In particular, the inverse relationship between cognitive ability and delinquency tended to be the strongest when predicting the early onset and the persistence of offending. Nevertheless, the pattern of statistical significance/nonsignificance across the

### TABLE 5
SUMMARY TABLE OF FINDINGS FOR COGNITIVE ABILITY AND DELINQUENCY

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Onset</th>
<th>Early Onset</th>
<th>Persistence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistically significant direct effect</td>
<td>Statistically significant direct effect</td>
<td>Statistically significant direct effect</td>
<td></td>
</tr>
<tr>
<td><strong>Mediating effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive ability partially mediates concentrated disadvantage</td>
<td>Cognitive ability mediates concentrated disadvantage</td>
<td>No mediating effects emerge</td>
<td></td>
</tr>
<tr>
<td><strong>Interaction effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No interaction terms emerge as statistically significant</td>
<td>No interaction terms emerge as statistically significant</td>
<td>No interaction terms emerge as statistically significant</td>
<td></td>
</tr>
</tbody>
</table>
various model specifications indicated that the effect of cognitive ability on delinquency was most consistent when predicting the onset of offending. These findings indicate that (a) the developmental/life-course perspective in criminology has particular relevance when applied to the cognitive ability/delinquency relationship, and (b) correctional interventions that target cognitive ability as a factor for change should be structured to accommodate such differences depending on an individual’s stage of offending.

Overall, we hope that the work presented here will help to clarify a portion of the debate surrounding the relationship between cognitive ability and delinquency. Specifically, by avoiding the empirical, conceptual, and even ideological problems associated with using IQ as a proxy for cognitive ability, our alternative measure may reveal a certain level of convergent validity within the growing body of studies assessing the cognitive ability/delinquency link. Aside from the recommendations noted above, the next step for researchers is to explicate more fully the mechanisms—or processes—by which variations in cognitive ability are related to delinquent behavior. Perhaps in doing so criminologists would be able to see more clearly how cognitive ability may fit well within—as opposed to being in opposition to—the dominant paradigms in contemporary criminological theory.

NOTES

1. The Inter-University Consortium for Political and Social Research does not permit access to the larger sample of 2,958. We are therefore unable to confirm Denno’s (1990) assertions and must trust their accuracy.

2. Recognizably, the measures of the criminal career capture general delinquency rather than any particular domains. By using such an aggregate measure, we may potentially miss distinctive patterns or trends in significance. For example, if one were to remove relatively minor infractions such as underage drinking and marijuana use from the analysis, would cognitive ability remain a robust predictor? Although the data do not permit this investigation, it is certainly a relevant pathway for future research.

3. Despite our critique of IQ as a measure, some may ask whether the California Achievement Test (CAT) is essentially the same measure as IQ, and/or why this variable was not included in our analyses to assess its importance relative to CAT. Although the full scale IQ variable and the overall battery score on the CAT are correlated ($r = .508, p < .01$), perfect, or even high, collinearity does not emerge. In regard to the latter concern, in analyses not reported here, IQ was included in the regression models. It does not emerge as a significant predictor for any of the three dependent variables when controlling for low birth weight, concentrated disadvantage, or sex. Additionally, the CAT variable does not lose significance when controlling for IQ.

4. It is important to note that the CAT score may also be a measure of the competency of the school program. Indeed, a child with a proficient cognitive ability may perform poorly on the CAT because of inadequate teachers or curricula. The fact that all of the youths in this sample attended public schools in Philadelphia, however, probably serves as an inherent control for this variable. Even so, one should not assume that a poor score on the CAT is entirely reflective of individual ability to the exclusion of educational influences.

5. In the present study we define cognitive ability in the rather traditional sense of the ability to process and retain information, and to exhibit linguistic and local-mathematical skills (see, e.g., Gardner, 1983).
6. The analyses did not include a three-way interaction term for low birth weight, concentrated disadvantage, and cognitive achievement to address Moffitt’s (1993) life-course persistence interactional hypothesis. In analyses not reported here, we did include such an interaction term. This variable was not a significant predictor for any of the three dependent variables and had no effect on the significance levels of the cognitive ability variable across all three sets of models.

ACKNOWLEDGMENT

The authors wish to thank Amie Schuck for her help and support at the beginning stages of this project.

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