

# Biosocial Risk Factors and Juvenile Violence

BY PATRICIA A. BRENNAN, PH.D.  
*Assistant Professor, Emory University*

INDIVIDUALS AGED 15 to 24 years have higher rates of violent crime than any other age group in our society. Moreover, aggression has been found to be stable from early childhood through adolescence and into adulthood. In addition, multiple cohort studies indicate that a small percentage of criminal offenders (about 6–8 percent) commit the majority (60 percent or more) of all violent criminal offenses within a given population (Loeber, Farrington, & Waschbusch, 1998). Due to the fact that chronic offenders have an earlier age of onset and aggression has been found to be relatively stable over time, juvenile onset offending is an area of major concern for our society.

Two government-funded reports have recently been published on the topic of juvenile violence. One is a report to Congress on juvenile violence research (Bilchik, 1999) and the other is an edited volume on the topic of serious and violent juvenile offending (Loeber & Farrington, 1998). The latter report examined risk and protective factors for serious juvenile violence as well as the relative effectiveness of various interventions with these youth. Risk factors at the individual, family, peer, and neighborhood levels were examined and discussed. The report to Congress also examined the causes and correlates of juvenile violence, although it focused on specific studies recently undertaken in major cities in the United States. This report suggested that interventions for juvenile violence should focus on reducing access to firearms and membership in gangs, as well as targeting particular situational factors (e.g., times and locations) that play an important role in juvenile violence.

As I read these recent reports, I noted the conspicuous absence of any substantial discussion about the role of biology in the outcome of juvenile violence. In one way, this is not surprising, as most current criminological theories do not include any reference to biology. On the other hand, the idea that a complex behavior such as violence would not at least be influenced by biological factors seems implausible. It does not make sense to focus on the environment to the exclusion of biology, just as it would not make sense to focus on genetic and biological factors outside of the context of the environment. In fact, recent discoveries in the area of neuroscience make it clear that the nature versus nurture debate as it relates to human behavior is now defunct. Work on gene expression reveals that nature and nurture (genes and environment) are inextricably intertwined from the very earliest stages of development. The expression of genes and the development of the cells of the brain and nervous system depend upon the actions of hormones, neurotransmitters, and growth factors which, in turn, are influenced by the environment in which we devel-

op. Moreover, environmental effects on the brain are not restricted to prenatal development, but rather continue throughout our life (Niehoff, 1999).

One criminological theory that attempts to capture this transactional, developmental process between biological factors and the environment is Moffitt's life-course persistent offender theory (Moffitt, 1993). According to this theory, persistent offending occurs as the result of neuropsychological vulnerabilities interacting with poor parenting throughout the course of early development. My colleagues and I have examined prenatal and perinatal factors as potential markers or causes of the neuropsychological risk factors in this process. We have noted, for example, that the rate of maternal cigarette smoking during the third trimester of pregnancy is related to persistent criminal offending in male offspring. This relationship remains significant when potential confounds such as socioeconomic status, parent psychopathology, father crime, maternal rejection, and perinatal complications are controlled (Brennan, Grekin & Mednick, 1999). My colleagues and I have also found evidence that early-life biosocial interactions can predict to violence in adulthood. For example, delivery complications interact with maternal rejection in the prediction of violence in males, and in particular violent arrests during adolescence (Raine, Brennan, & Mednick, 1994; Raine, Brennan & Mednick, 1997). We theorized that delivery complications result in damage to the central nervous system which makes behavior less controllable, and that when these CNS deficits are combined with parenting deficits, the risk for violence is increased.

In retrospect, our conceptualization and measurement of this and other biosocial interactions seems artificially simplistic. Current research in neuroscience suggests that the biosocial interaction process that results in violent behavior is far more complex than two static factors interacting with one another at one point in time. Moreover, the labeling of a risk factor as entirely "biological" or "social" may not be sensible, as environmental factors have biological consequences and vice versa. Nevertheless our work does take the first step of looking at biology and environment together as factors that influence criminal outcomes.

One of the primary goals of future biosocial research will be to further elucidate the interactional processes of the brain and environment as they relate to outcomes of aggression and violence. Another goal will be to determine more specifically which biosocial factors play an important role in this developmental process. For example, one environmental factor that might have a particularly pernicious effect both on the brain and on aggression is environmental

stress. Animal research has shown that disruption of the early environment can increase the sensitivity of the nervous system to stress in the future. Indeed, this sensitization to stress may be one mediating factor between delivery complications (early stressor) and violence. The brain's responsiveness to stress can be altered throughout childhood and adulthood. For example, there is evidence that children who witness a shooting have increased startle responses for years following that stressful life event.

The startle response is one of the body's natural responses to a threat in the environment. Neuroscientists have studied emotional responses to fear cues using startle response paradigms and other fear conditioning paradigms in the laboratory. Interestingly, they have found a similarity in areas of the brain that regulate fear and aggression (LeDoux, 1996). The amygdala and the frontal cortex are two of these brain areas. The amygdala is a brain component that is essential for the detection and response to threat cues. Threat cues that are detected by the amygdala may also be processed and interpreted by the frontal cortex. This higher level of interpretation allows the individual to discriminate and generalize different threat cues and to respond more consciously to emotional stimuli. In other words, it allows people to inhibit their responses to stress and threats in the environment. Brain imaging studies have also indicated that the frontal cortex may play an important role in the inhibition of criminal violence. For example, Raine and his colleagues found that the prefrontal cortex and orbitofrontal cortex of murderers were both less active than those of control subjects during laboratory attention tasks (Raine, 1993). Raine suggested that violent individuals therefore might not be able to regulate or inhibit the responses of subcortical structures (such as the amygdala) that facilitate aggressive behavior. Taken together, these neurological findings suggest that aggressive behavior may occur as an unchecked response to a threatening or hostile environment.

The notion that some juvenile offenders might be overly sensitive to stress and may become aggressive in reaction to hostile cues in the environment is not necessarily inconsistent with the more widely held belief that many young violent offenders are non-anxious, guiltless psychopaths. In fact both types of juvenile violent offenders may exist. Dodge has described this two-part typology of childhood aggression as the reactive versus proactive typology (Dodge & Coie, 1987). According to Dodge, reactive children are aggressive in response to a real or imagined threat in the environment, whereas proactive children use aggression to achieve some goal or instrumental purpose. Reactive offenders may have an overly sensitive psychophysiological response to stress as outlined above. Proactive offenders, in contrast, might suffer from low arousal or a lack of fear.

Evidence that some antisocial children may have lower levels of arousal comes from studies on resting heart rate levels (Raine, 1993). Antisocial children have lower resting heart rates in comparison to controls, and this effect is both strong and well-replicated. Raine has offered several possible interpretations for these heart rate findings. First, he

suggests that low resting heart rate may reflect a lack of fear. This lack of fear would enable antisocial children to forge ahead into aggressive encounters, and would also explain their apparent nonresponsiveness to punishment cues. Another interpretation that Raine offers for the heart rate findings is the idea that antisocial children may be underaroused at baseline levels. This is significant because humans have an optimal level of arousal—if they are underaroused, they will seek out situations that will raise that arousal level. Underaroused children might therefore seek out risky situations and become more involved with criminal behavior as a method of thrill-seeking. Lack of fear and thrill-seeking behavior are characteristics of adult psychopaths—these antisocial children might therefore develop into psychopaths as adults.

In fact, recent research suggests that some of the hallmark characteristics of adult psychopaths, including a lack of empathy and emotional responsiveness, can be seen in a subgroup of antisocial children (Frick, 1995). These callous-unemotional children differ from other antisocial children both in terms of etiology and outcomes. To date, they have not been compared to other antisocial subgroups in terms of their neurological or psychophysiological features. Proactive and reactive children, as well, have yet to be studied in terms of potential biological differences. Such future studies will help determine the potential role of biology in the differentiation between subgroups of antisocial and violent youth.

As I have stated, an exclusionary focus on biological factors would not be a sensible approach to the problem of juvenile violence. And it is highly likely that some environmental conditions might cause individuals with normally functioning brains to act in a violent manner. I believe that a biosocial approach to violence does not de-emphasize the importance of the social environment, but rather re-emphasizes it. The environment is a powerful influence on both our behavior and our biological functioning. A biosocial approach, therefore, is not deterministic. Instead it suggests that there are many levels at which one could intervene to disrupt the process of development that leads to violent behavior. Consider, for example, our findings on the interaction between delivery complications and maternal rejection. Our results revealed that delivery complications did not increase the risk for violence unless the mother was also rejecting, and that maternal rejection did not increase the risk for violence unless there was a history of perinatal insult. Therefore, prevention programs could be targeted at prenatal education or at parenting skills—either intervention alone would disrupt this interactive process.

Violent offenders often have an early age of onset for aggressive behavior. This early age of onset suggests that early risks may play an especially important role in this process. Therefore, early intervention and prevention programs would seem to be ideal solutions to combat juvenile violence. However, biosocial research does not suggest that once this developmental process leading to aggression and violence has begun, it can never be undone. Nor does it nec-

essarily suggest the need for drug therapy or direct biological interventions. To the contrary, new findings suggest that brain functioning, like behavior and attitudes, can be changed through psychological interventions such as cognitive behavioral therapy. A greater understanding of the complex, interactive, biosocial process that leads to juvenile violence will allow for a greater number of options in the intervention and prevention of this behavior.

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