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Prenatal Influences and Crime

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Over the past 20 years, researchers have made considerable progress in uncovering various social, psychological, and biological risk factors that [p. 733 ↓] predispose to criminal behavior. One area in particular that has received increasing attention has been the role of early health risk factors in contributing to antisocial behavior. A large body of research has now convincingly demonstrated that several prenatal risk factors—including malnutrition, birth complications, and prenatal nicotine and alcohol exposure—significantly increase risk for antisocial and criminal behavior across the lifespan. Research has increasingly revealed that childhood externalizing behavior, such as conduct disorder, aggression and hyperactivity, represents a major predisposition to adult crime and violence. Thus, insight into the etiology of childhood antisocial behavior is critical to attempts to understand, and possibly prevent, adult criminality. Research on prenatal influences on crime has generally focused on four main domains: minor physical abnormalities, prenatal nicotine and alcohol exposure, birth complications, and malnutrition.

Minor Physical Abnormalities

Minor physical abnormalities (MPAs) have been associated with pregnancy disorders and are considered to be indicators of fetal neural maldevelopment near the end of the first trimester (Firestone & Peters, 1983). Since the epidermis and the central nervous system (CNS) have shared embryological origins, MPAs are seen as indirect markers of atypical CNS and brain development. MPAs consist of fairly minor physical abnormalities such as low-set ears, adherent ear lobes, and a furrowed tongue. Although there may be a genetic component to MPAs, they may also be caused by environmental factors that affect the fetus, such as anoxia, bleeding, and infection (Guy et al., 1983).

Several studies have found a relationship between elevated numbers of MPAs and increased antisocial behavior in children, adolescents, and adults. In particular, MPAs have been linked to violent as opposed to nonviolent offending. For instance, Arseneault, Tremblay, Boulerice, Seguin, and Saucier showed that MPAs measured at age 14 in 170 males predicted violent but not nonviolent delinquency at age 17. The authors reported that these effects were independent of childhood physical aggression

or family adversity. In another study by Kandel, Brennan, Mednick, and Michelson, an increased level of MPAs was associated with recidivistic violent criminal behavior. The authors assessed MPAs in 265 11- to 13-year-old Danish children, and found that recidivistic violent offenders had a greater number of MPAs compared with subjects with one or no violent offenses, according to police records of criminal behavior when the subjects were 20 to 22 years of age. These studies suggest that prenatal insults toward the end of the first 3 months of pregnancy may increase risk for violent behavior as a result of abnormal brain development.

A number of studies have also reported that MPAs interact with social factors in predisposing to violent and antisocial behavior. A 1988 study by Mednick and Kandel measured MPAs in 129 boys during visits to a pediatrician at age 12. The authors found that MPAs were associated with violent crime, but not nonviolent property offenses, when the subjects were 21 years old. Interestingly, however, when the authors divided subjects into those from unstable, nonintact families and those from stable families, they found that MPAs only predicted later criminal involvement for those reared in unstable, nonintact homes. A similar finding was reported by Brennan, Mednick, and Raine, who evaluated adult violent offenses in a sample of 72 male offspring of parents with psychiatric diagnoses. The authors found particularly high rates of adult violent crime in individuals who had both family adversity and MPAs compared to those who had only one of these risk factors. In another study, Pine, Shaffer, Schonfeld, and Davies investigated the interaction of MPAs and environmental risk factors, such as low socioeconomic status, spousal conflict, and marital disruption, in predicting later disruptive behavior disorders. The authors found a significant interaction between MPAs and environmental risk, such that individuals with both increased MPAs and environmental risk, assessed at age 7, were at greater risk for disruptive behavior in general and for conduct disorder, in particular, at age 17. These three studies suggest that MPAs interact with adverse environmental experiences such that psychosocial factors lead to antisocial and violent behavior more strongly, and sometimes only, among individuals with high biological risk. Neurological abnormalities such as MPAs thus appear to increase susceptibility to psychosocial risk factors for antisocial and violent behavior.

[p. 734 ↓]

Prenatal Nicotine and Alcohol Exposure

Extensive evidence has now established beyond a reasonable doubt that children who are exposed to maternal smoking during pregnancy are at increased risk for later antisocial behavior that extends over the life course. Maternal prenatal smoking has been shown to predict conduct disorder, delinquency, and adult criminal and violent offending. Several studies have also reported a dose-response relationship between the extent of maternal smoking during pregnancy and the extent of later antisocial behavior in offspring.

In addition to nicotine exposure, it has long been established that fetal alcohol exposure significantly increases risk for antisocial behavior in adolescents and adults. Heavy alcohol consumption while pregnant can result in fetal alcohol syndrome (FAS), which is characterized by a host of cognitive, behavioral, social, and physical deficits. However, Schonfeld, Mattson, and Riley have observed deficits even in those who have been prenatally exposed to alcohol who do not meet diagnostic criteria for FAS. For instance, research has found high rates of delinquency in children and adolescents with heavy fetal alcohol exposure, even if they do not have FAS. In addition, studies have shown that adolescents who were prenatally exposed to alcohol are overrepresented in the juvenile justice system. One study by Fast, Conry, and Looock revealed that 3 percent of adolescents in a juvenile inpatient forensic psychiatry unit were diagnosed with FAS, and 22 percent were diagnosed with fetal alcohol effects. Another study by Streissguth et al. reported that 61 percent of adolescents, 58 percent of adults, and 14 percent of children between the ages of 6 and 11 with fetal alcohol exposure had a history of trouble with the law.

Several studies have documented interactions between maternal prenatal smoking and psychosocial risks in the prediction of later violence. These studies are notable for their large sample sizes, assessment of long-term outcomes, prospective data collection, and control for potential confounds such as parental antisocial behavior, drug use, and low socioeconomic status. For instance, Brennan, Grekin, and Mednick examined the number of cigarettes smoked daily during pregnancy by the mothers of 4,169 males born between 1959 and 1961 in Copenhagen, Denmark. The authors found a dose-response relationship between the extent of prenatal maternal smoking

and the extent of nonviolent and violent crime when the subjects were 34 years of age. Moreover, these effects were specific to persistent criminal behavior, rather than that confined to adolescence. Among subjects whose mothers smoked 20 cigarettes a day while pregnant, there was a twofold increase in adult violent offending, according to arrest records. However, the authors found that when maternal prenatal smoking was combined with delivery complications, there was a fivefold increase in adult violent offending; in contrast, prenatal nicotine exposure without delivery complications did not lead to increased violence in offspring. In another study, Rasanan et al. reported that the offspring of women who smoked during pregnancy had a twofold increase in violent crime at age 26, and that, when prenatal nicotine exposure was combined with being raised in a single-parent family, there was an 11.9-fold increase in recidivistic violent offending. Moreover, prenatal nicotine exposure led to a 14.2-fold increase in recidivistic violence when combined with four psychosocial risk factors: teenage pregnancy, single-parent family, unwanted pregnancy, and developmental motor delays. In this study, as in the one above, risk was particularly increased for persistent violent offending, rather than violence in general or property crime. Finally, a 2000 study by Gibson and Tibbetts documented an interaction between prenatal nicotine exposure and parental absence in predisposing to early onset of antisocial behavior and offending.

Birth Complications

In addition to MPAs and prenatal nicotine and alcohol exposure, research has also focused on birth complications, such as premature birth, low birth weight, placement in a neonatal intensive care unit, forceps delivery, Cesarean section, anoxia, resuscitation needed after delivery, pre-eclampsia in the mother, and low Apgar score. A number of well-designed studies have demonstrated that obstetric complications interact with psychosocial risk factors in predicting conduct disorder, delinquency, and impulsive crime and violence in adulthood. For example, Werner found [p. 735 ↓] that birth complications combined with a disruptive family environment (which included such experiences as maternal separation, illegitimacy, marital discord, parental mental health problems and paternal absence), predisposed to delinquency over and above either biological or psychosocial risk factor independently.

Two prospective longitudinal studies by Raine, Brennan, and Mednick in 1994 and 1997 also provide evidence of the importance of biosocial interactions in predicting violent crime. In the first of these studies, Raine et al. evaluated whether the early experience of extreme maternal rejection (e.g., unwanted pregnancy, attempts to abort the fetus, and institutional care of the infant during the first year of life) interacted with birth complications in predisposing to adult violent crime in a sample of 4,269 males born in Copenhagen, Denmark, between 1959 and 1961. The authors found that birth complications significantly interacted with maternal rejection in predisposing to violent crime at 18 years of age. The importance of this finding is highlighted by the fact that while only 4 percent of the sample experienced both birth complications and maternal rejection, this group was responsible for 18 percent of the violent offenses perpetrated by the whole sample. In a subsequent study, the same authors followed up this sample to age 34 to reassess criminal violence. The authors replicated the biosocial interaction for violent but not nonviolent crime. In addition, they found that the results applied specifically to serious violence, rather than violent threats, and to early-onset as opposed to late-onset violence. Similar biosocial interactions between obstetric complications and various psychosocial risk factors (e.g., parental mental illness, poor parenting, familial adversity) have been reported in studies using large samples from around the world.

In contrast to this, two studies failed to find an interaction between birth complications and environmental risk factors: a 2002 study by Cannon et al. and a 2000 study by Laucht et al. However, there are several notable differences between these studies and those cited above. In the first of these studies, the sample consisted of 601 individuals with schizophrenia spectrum disorders; thus, there may have been other differences in brain functioning in this population that obscured findings related to violence. In the second of these studies, follow-up of a small sample of 322 children was limited to age 8. Some authors have suggested that CNS insults resulting from perinatal complications may be especially related to life-course-persistent antisocial behavior rather than to child antisocial behavior. Thus, the vast majority of the evidence suggests that birth complications combined with psychosocial risk factors predispose to violent crime.

While not a birth complication per se, evidence from Ikaheimo et al. also suggests that a high body mass index (BMI) and small head circumference at age 12 months are associated with a substantially increased risk of violent but not non-violent offending

in adulthood. Interestingly, the authors found that measures of BMI at age 1 were stronger predictors of violent behavior than measures of BMI at age 14, which they argue implicates genetic and early environmental factors, rather than social learning, in accounting for the relationship between BMI and violence.

Malnutrition

There is growing recognition that along with other early health risk factors, malnutrition represents an important risk factor for the development of antisocial behavior in children and adults. Research on malnutrition has focused on both macromalnutrition, such as protein-energy malnutrition, and malnutrition caused by micronutrient deficiencies, such as iron and zinc micromalnutrition. Epidemiological studies have documented associations between increased aggressive behavior and vitamin and mineral deficiency (Werbach, 1992). Further support for the link between malnutrition and antisocial behavior comes from a study by Neugebauer, Hoek, and Susser. They demonstrated that the male offspring of nutritionally deprived pregnant women had 2.5 times the normal rate of antisocial personality disorder in adulthood when malnutrition occurred during the first and second trimesters of pregnancy—the period of time when brain growth is most rapid.

While the links described above are intriguing, they do not provide conclusive evidence of a relationship between malnutrition and antisocial behavior. More compelling evidence that malnutrition leads to antisocial behavior comes from a number of experimental studies in both children [p. 736 ↓] and adults. Although not focused specifically on the prenatal period, a recent longitudinal prospective study by Liu et al. presents a particularly powerful illustration of how early childhood malnutrition may predispose to antisocial behavior later in life. In this study, Liu et al. demonstrated that children with iron, zinc or protein deficiencies at age 3 had greater externalizing behavior problems at ages 8, 11, and 17. In comparison to control subjects, malnourished children at age 3 were more aggressive or hyperactive at age 8, had more externalizing behavior at age 11, and had greater conduct disorder and excessive motor activity at age 17. Behavior problems were measured with three different instruments at each age, suggesting that findings were largely invariant to the nature of measurement. Findings were also independent of psychosocial adversity

and not moderated by gender. Moreover, Liu et al. found a dose-response relationship between the extent of malnutrition at age 3 and the extent of behavior problems at ages 8 and 17, suggesting that malnutrition was an important factor in predisposing to antisocial behavior.

Effects of early nutritional interventions on later behavior have also been found. Although not specific to nutritional enrichment, one highly successful early intervention for criminal and antisocial behavior consisted of home visits by nurses to mothers in which nutritional guidance was a major component. A randomized controlled trial by Raine et al. in 2003 also demonstrated that an enrichment program consisting of nutrition, education, and physical exercise from ages 3 to 5 significantly reduced antisocial behavior at age 17 and criminal behavior at age 23. Moreover, the authors found that the beneficial effects of the intervention were greater for children who exhibited signs of malnutrition at age 3, suggesting that the nutritional components of the intervention were the active elements in the enrichment program. Prevention, intervention, and treatment studies focused on malnutrition thus represent a promising direction for future research.

Conclusion

A substantial body of evidence suggests that several prenatal risk factors predispose to adult antisocial behavior and violence. Research has specifically linked minor physical anomalies, in utero nicotine and alcohol exposure, birth complications and malnutrition to later aggression and crime. Supporting evidence comes from a range of studies using diverse methodologies, including intervention approaches, early childhood enrichments, and prospective longitudinal designs. This methodological diversity, in addition to the experimental nature of some studies, lends further support to the relationship between health risk factors and antisocial behavior. The studies detailed above suggest that prevention efforts aimed at increasing maternal prenatal health and childhood nutrition and interventions designed to reduce birth complications and other causes of brain dysfunction may represent viable approaches for reducing violent crime.

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See also

- [Brain Abnormalities and Crime](#)
- [Environmental Toxins Theory](#)
- [Lahey, Benjamin B., and Irwin D. Waldman: Developmental Propensity Model](#)
- [Mednick, Sarnoff A.: Autonomic Nervous System \(ANS\) Theory](#)
- [Moffitt, Terrie E.: A Developmental Model of Life-Course-Persistent Offending](#)
- [Nutrition and Crime](#)
- [Raine, Adrian: Crime as a Disorder](#)

References and Further Readings

Arseneault, L., Tremblay, R. E., Boulerice, B., Seguin, J. R., and Saucier, J. F. Minor physical anomalies and family adversity as risk factors for violent delinquency in adolescence . *American Journal of Psychiatry* 157 917–923. (2000). <http://dx.doi.org/10.1176/appi.ajp.157.6.917>

Brennan, P. A., Grekin, E. R., and Mednick, S. A. Maternal smoking during pregnancy and adult male criminal outcomes . *Archives of General Psychiatry* 56 215–219. (1999). <http://dx.doi.org/10.1001/archpsyc.56.3.215>

Brennan, P. A., Mednick, S. A., & Raine, A. (1997). Biosocial interactions and violence: A focus on perinatal factors . In A. Raine, ed. , P. A. Brennan, ed. , D. Farrington, ed. , & S. A. Mednick (Eds.), *Biosocial bases of violence* (pp. 163–174). New York: Plenum.

Cannon, M., Huttenen, M. O., Tanskanen, A. J., Arseneault, L., Jones, P. B., and Murray, R. M. Perinatal and childhood risk factors for later criminality and violence in schizophrenia . *British Journal of Psychiatry* 180 496–501. (2002). <http://dx.doi.org/10.1192/bjp.180.6.496>

Fast, D. K., Conry, J., and Loock, C. A. Identifying Fetal Alcohol Syndrome among youth in the criminal justice system . *Journal of Developmental and Behavioral Pediatrics* 20 370–372. (1999). <http://dx.doi.org/10.1097/00004703-199910000-00012>

Firestone, P., and Peters, S. Minor physical anomalies and behavior in children: A review . *Journal of Autism and Developmental Disorders* 13 411–425. (1983). <http://dx.doi.org/10.1007/BF01531589>

Galler, J. R., and Ramsey, F. A follow-up study of the influence of early malnutrition on development . *Journal of the American Academy of Child and Adolescent Psychiatry* 26 23–27. (1989). <http://dx.doi.org/10.1097/00004583-198701000-00005>

Gibson, C. L., Piquero, A. R., and Tibbetts, S. G. Assessing the relationship between maternal cigarette smoking during pregnancy and age at first police contact . *Justice Quarterly* 17 519–542. (2000). <http://dx.doi.org/10.1080/07418820000094651>

Guy, J. D., Majorski, L. V., Wallace, C. J., and Guy, M. P. The incidence of minor physical anomalies in adult male schizophrenics . *Schizophrenia Bulletin* 9 571–582. (1983).

Ikaheimo, P., Rasanen, P., Hakko, H., Hartikainen, A., Laitinen, J., and Hodgins, S., et al. Body size and violent offending among males in the Northern Finland 1966 birth cohort . *Social Psychiatry and Psychiatric Epidemiology* 42 845–850. (2007). <http://dx.doi.org/10.1007/s00127-007-0231-y>

Kandel, E., Brennan, P. A., Mednick, S. A., and Michelson, N. M. Minor physical anomalies and recidivistic adult criminal behavior . *Acta Psychiatrica Scandinavica* 79 103–107. (1989). <http://dx.doi.org/10.1111/acp.1989.79.issue-1>

Laucht, M., Esser, G., Baving, L., Gerhold, M., Hoesch, I., and Ihle, W., et al. Behavioral sequelae of perinatal insults and early family adversity at 8 years of age . *Journal of the American Academy of Child and Adolescent Psychiatry* 39 1229–1237. (2000). <http://dx.doi.org/10.1097/00004583-200010000-00009>

Liu, J., Raine, A., Venables, P., and Mednick, S. A. Malnutrition at age 3 years predisposes to externalizing behavior problems at ages 8, 11 and 17 years . *American Journal of Psychiatry* 161 2005–2013. (2004). <http://dx.doi.org/10.1176/appi.ajp.161.11.2005>

Mednick, S. A., and Kandel, E. S. Congenital determinants of violence . *Bulletin of the American Academy of Psychiatry and the Law* 16 101–109. (1988).

Neugebauer, R., Hoek, H. W., and Susser, E. Prenatal exposure to wartime famine and development of antisocial personality disorder in early adulthood . *Journal of the American Medical Association* 4 479–481. (1999).

Pine, D. S., Shaffer, D., Schonfeld, I. S., and Davies, M. Minor physical anomalies: Modifiers of environmental risks for psychiatric impairment? *Journal of the American Academy of Child and Adolescent Psychiatry* 36 395–403. (1997). <http://dx.doi.org/10.1097/00004583-199703000-00019>

Raine, A. Biosocial studies of antisocial and violent behavior in children and adults: A review . *Journal of Abnormal Child Psychology* 30 311–326. (2002). <http://dx.doi.org/10.1023/A:1015754122318>

Raine, A., Brennan, P., and Mednick, S. A. Birth complications combined with early maternal rejection at age 1 year predispose to violent crime at age 18 years . *Archives of General Psychiatry* 51 984–988. (1994). <http://dx.doi.org/10.1001/archpsyc.1994.03950120056009>

Raine, A., Brennan, P., and Mednick, S. A. Interaction between birth complications and early maternal rejection in predisposing individuals to adult violence: Specificity to serious, early-onset violence . *American Journal of Psychiatry* 154 1265–1271. (1997).

Raine, A., Mellingen, K., Liu, J. H., Venables, P. H., and Mednick, S. A. Effects of environmental enrichment at 3–5 years on schizotypal personality and antisocial behavior at ages 17 and 23 years . *American Journal of Psychiatry* 160 1627–1635. (2003). <http://dx.doi.org/10.1176/appi.ajp.160.9.1627>

Rantakallio, P., Laara, E., Isohanni, M., and Moilanen, I. Maternal smoking during pregnancy and delinquency of the offspring: An association without causation? *International Journal of Epidemiology* 21 1106–1113. (1992). <http://dx.doi.org/10.1093/ije/21.6.1106>

Rasanen, P., Hakko, H., Isohanni, M., Hodgins, S., Jarvelin, M. R., and Tiihonen, J. Maternal smoking during pregnancy and risk of criminal behavior among adult male offspring in the northern Finland 1996 birth cohort . *American Journal of Psychiatry* 156 857–862. (1999).

Scarpa, A., & Raine, A. (2007). Biosocial bases of violence . In D. J. Flannery, ed. , A. T. Vazsonyi, ed. , & I. D. Waldman (Eds.), *The Cambridge handbook of violent behavior and aggression* (pp. 151–169). Cambridge, UK: Cambridge University Press. <http://dx.doi.org/10.1017/CBO9780511816840.008>

Schonfeld, A. M., Mattson, S. N., and Riley, E. P. Moral maturity and delinquency after prenatal alcohol exposure . *Journal of Studies on Alcohol* 66 545–554. (2005).

Streissguth, A. P., Barr, H. M., Kogan, J., & Bookstein, F. L. (1996). Understanding the occurrence of secondary disabilities in clients with fetal alcohol syndrome (FAS) and fetal alcohol effects (FAE) . Washington, DC: Centers for Disease Control and Prevention.

Wakschlag, L. S., Pickett, K. E., Cook, E. C., Benowitz, N. L., and Leventhal, B. L. Maternal smoking during pregnancy and severe antisocial behavior in offspring: A review . *American Journal of Public Health* 92 966–974. (2002). <http://dx.doi.org/10.2105/AJPH.92.6.966>

Werbach, M. R. Nutritional influences on aggressive behavior . *Journal of Orthomolecular Medicine* 7 45–51. (1992).

Werner, E. E. (1987). Vulnerability and resiliency in children at risk for delinquency: A longitudinal study from birth to young adulthood . In J. D. Burchard, ed. , & S. N. Burchard (Eds.), *Primary prevention of psychopathology* (pp. 16–43). Newbury Park, CA: Sage.