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In recent years it has been made apparent that exposure to lead is a significant problem for many individuals and families. Lead exposure–whether through the air, water, or by ingestion–has been linked to numerous physical, cognitive, and social problems (Chandramouli, 2009; Nevin, 2007). Furthermore, urban, poor and immigrant populations are at a higher risk for lead exposure (Bakhireva, et al., 2013). And increasingly a connection between lead exposure and criminal behavior has been identified through both correlational studies and experiments. The high cost of exposure to lead is apparent when looking at the effects of lead over a lifetime, and should be avoided if at all possible.

Lead can start to have negative effects on an individual before birth, as prenatal exposure is one of the most damaging time frames for people to be exposed. Prenatal exposure has been linked to reduced intellectual development, low academic achievement and behavioral problems (Chandramouli, 2009; Marcus, Fulton, & Clarke, 2010; Nevin, 2007; Olympia, Goncalves, Gunther, & Bechara, 2009). Additionally, Braun, Kahn, Froehlich Auinger, & Lanphear (2006) examined prenatal lead exposure and the presence of Attention Deficit Hyperactivity Disorder (ADHD) in children 4-15 years old. This study found that exposure to lead prenatally was a risk factor for ADHD. Similarly, postnatal or early childhood exposure is also dangerous but more likely to occur because young children are often on the floor; where dust and paint chips are common, and children may eat paint chips because they taste sweet (Weisskopf, 2004). These early windows of exposure are especially dangerous as lead can affect a child's development–both mental and physical–and the lead can stay in a child’s body for many years as they grow (Cole & Winsler, 2010).

Lead exposure continues to be dangerous throughout childhood, and whether a child was exposed as a baby, toddler, or throughout the lifespan, this exposure can have many lasting consequences. Behavioral effects are especially detrimental to children and can be examined in two different categories: behavioral impairments and relationship difficulties. To start, behavioral impairments include problems such as difficulty with emotional regulation, impulsivity, aggression and anxiety (Nevin 2007; Reyes, 2015;Winter & Sampson, 2017). Burns, Baghurst, Sawyer, McMichael, and Tong (1999) conducted a study on children ages 11-13, in which lead exposure was measured and compared to results from the Child Behavior Checklist, completed by each child's mother. This study found a significant relationship between lead exposure and later emotional and behavioral problems. Furthermore, numerous studies have examined lead's association with ADHD. Nigg and colleagues (2009) found through a study with 236 children that an elevated blood lead level (BLL), above the national average in children, was associated with increased rates of ADHD. Another study, which looked at 756 children between 3 and 7 years of age, found a similar link between lead and ADHD, adding that executive functioning and attention are traits that are particularly susceptible to change (Roy et al., 2009).

A second behavioral outcome of lead exposure that can be seen during childhood is an increase in relationship difficulties. Children who were exposed to lead prenatally are at a greater risk for having Conduct Disorder (Braun et al., 2008). Furthermore, a study that followed children from birth to three years old found that lead exposure was related to Destructive and Withdrawn behavior problems (Wasserman, Staghezza-Jaramillo, Shrout, Popovac, & Graziano, 1998). Relationships are often the basis for emotional stability, especially in childhood. A lack of emotional stability can negatively impact a child's future behavior and academic work.

In adolescence and young adulthood, school problems related to lead exposure can be seen. Needleman, Schell, Bellinger, Leviton, & Allred (1990) reexamined young adults who had been studied during their childhood in order to study the long-term effects of lead exposure during childhood. While the mean age of the 132 subjects was 18.4, this study found that impaired academic performance and cognitive functioning, which were both linked to lead exposure, persisted into young adulthood. Academic and cognitive consequences were seen through many factors, including failure to graduate from high school, lower class standing, greater absenteeism, and impairment of reading skills (Needleman et al., 1990). Another study examined the relationship between preschool BLLs and later behavior problems: BLL data was compared with information on the children's school suspension records (Aizer & Currie, 2017). This study found "that a one unit increase in BLLs increased the probability of suspension from school by 6.5 to 7% for boys and by 6.4 to 9.3% for girls" (p. 34).

School and behavioral problems, mainly ADHD, that are linked to lead exposure are significant because these problems serve as precursors to escalating behavioral patterns: most notably, crime (Nevin, 2000). In addition to finding a link between lead exposure and school suspension, Aizer and Currie's study also discovered that the probability of incarceration increases 27-74% with each one unit increase in BLL (2017). This study serves to indicate a link between school problems and crime. Moreover, many studies have shown that ADHD is closely related to criminal behavior. Young and Thome (2011) analyzed numerous key papers over ADHD and offenders and determined that, compared to the general rates, the rates of prisoners with ADHD is disproportionately high. Another study used meta-analysis to examine ADHD and incarcerated populations (Young, Moss, Sedgwick, Fridman, & Hodgkins, 2015). Young and colleagues found that compared to the the prevalence of ADHD in the general youth population

(3-7%) and the general adult population (1-5%), the prevalence of ADHD in the incarcerated populations was much greater (30.1% and 26.2%, respectively) (2015). In a study of 3,400 patients, ADHD was found to be a risk factor for later violent criminal behavior (Lundström et al., 2014).

While school problems and ADHD serve as the connecting link between lead exposure and criminal behavior, studies have also examined the relationship between lead exposure and criminality, directly. In one study of 250 people, Wright et al. (2008) found that prenatal and postnatal BLLs were related to higher rates of total and violent offense arrests: lead exposure could help predict adult arrests. Many studies comparing crime rates to lead exposure in various cities have found a correlation between the two. Exposure to lead through the air can be linked to higher rates of aggressive crime (Stretesky & Lynch, 2004; Taylor, Forbes, Opeskin, Parr, & Lanphear, 2016) and higher rates of aggravated assault (Mielke & Zahran, 2012). Similarly, lead exposure due to lead water pipes has been linked to increased homicide rates (Feigenbaum & Muller, 2016).

Whether a person is exposed to lead for a lifetime or for just a few short months as a child, lead can have a massive impact on that person's future. Changes in behavior, social relationships and cognitive ability in childhood lead to more severe problems in adolescence and adulthood. The overall effect of lead is an increase in violent and impulsive behavior, as well as an increase in population crime. While there are many confounding variables to be included in studies of this nature (such as socioeconomic status, childhood environment, and parental education), there are an overwhelming number of studies that all show the same outcomes. Although these studies may not be experimental, the vast number of studies, large sample sizes

in each study, and number of variables controlled for, altogether allow for a very strong correlational conclusion to be made: lead exposure is very closely related to criminal behavior.

References

Aizer, A. & Currie, J. (2017). Lead and juvenile delinquency: New evidence from linked birth, school, and juvenile detention records. Working Paper 23392 http://www.nber.org/papers/w23392 NATIONAL BUREAU OF ECONOMIC RESEARCH.

Bakhireva, L., Rowland, A., Young, B., Cano, S., Phelan, S., Artyushkova, K., & ... Lewis, J. (2013). Sources of potential lead exposure among pregnant women in New Mexico. *Maternal & Child Health Journal*, *17*(1), 172-179.

Braun, J. M., Kahn, R. S., Froehlich, T., Auinger, P., & Lanphear, B. P. (2006). Exposures to environmental toxicants and Attention Deficit Hyperactivity Disorder in U.S. children. *Environmental Health Perspectives, 114*(12), 1904-1909.

Braun, J. M., Froehlich, T. E., Daniels, J. L., Dietrich, K. N., Hornung, R., Auinger, P., & Lanphear, B. P. (2008). Association of environmental toxicants and conduct disorder in U.S. children: NHANES 2001-2004. *Environmental Health Perspectives, 116*(7), 956-962.

Burns, J., Baghurst, P., Sawyer, M., McMichael, A., & Tong, S. (1999). Lifetime low-level exposure to environmental lead and children's emotional and behavioral development at ages 11-13 years: The Port Pirie cohort study. *American Journal Of Epidemiology*, *149*(8), 740-749.

Chandramouli, K., Steer, C., Ellis, M., Emond, A., Chandramouli, K., Steer, C. D., & ... Emond, A. M. (2009). Effects of early childhood lead exposure on academic performance and behaviour of school age children. *Archives Of Disease In Childhood*, *94*(11), 844-848.

Cole, C. & Winsler, A. (2010). Protecting children from exposure to lead: Old problem, new data, and new policy needs. *Social Policy Report*, *24,* 3-23.

Feigenbaum, J. J. & Muller, C. (2016). Lead exposure and violent crime in the early twentieth century. *Explorations in Economic History*, *62*, 51–86.

Lundström, S., Forsman, M., Larsson, H., Kerekes, N., Serlachius, E., Långström, N., & Lichtenstein, P. (2014). Childhood neurodevelopmental disorders and violent criminality: A sibling control study. *Journal Of Autism & Developmental Disorders*, *44*(11), 2707-2716.

Marcus, D. K., Fulton, J. J., & Clarke, E. J. (2010). Lead and conduct problems: A meta analysis. *Journal Of Clinical Child & Adolescent Psychology*, *39*, 234-241.

Mielke, H.W. & Zahran, S. (2012). The urban rise and fall of air lead and the latent surge and retreat of social violence. *Environmental International*, 43, 48-55

Needleman, H., Schell, A., Bellinger, D., Leviton, A., & Allred, N. (1990). The long-term effects of exposure to low doses of lead in childhood: An 11-year follow-up report. *New England Journal of Medicine, 322*(2), 83-88.

Nevin, R. (2000). How lead exposure relates to temporal changes in IQ, violent crime, and unwed pregnancy. *Environmental Research Section A, 83,* 1-22.

Nevin, R. (2007). Understanding international crime trends: The legacy of preschool lead exposure. *National Center for Healthy Housing 104,* 315-36.

Nigg, J.T.., Nikolas, M., Knottnerus, G.M., Cavanagh, K., & Friderici, K. (2010). Confirmation and extension of association of blood lead with Attention-Deficit/Hyperactivity Disorder and ADHD symptom domains at population-typical exposure levels. *Child Psychology and Psychiatry, 51(1),* 58-65.

Olympio, K. P. K., Gonçalves, C., Günther, W. M. R., & Bechara, E. J. H. (2009). Neurotoxicity and aggressiveness triggered by low-level lead in children: A review. *Pan American Journal of Public Health,* 26(3), 266-275.

Reyes, J. W. (2015). Lead lead exposure and behavior: Effects on antisocial and risky behavior among children and adolescents. *Economic Inquiry, 53,* 1580-1605.

Roy, A., Bellinger, D., Hu, H., Schwartz, J., Ettinger, A. S., Wright, R. O., … & Balakrishnan, K. (2009). Lead exposure and behavior among young children in Chennai, India. *Environmental Health Perspective, 117,* 1607-1611.

Stretesky, P. B., & Lynch, M. J. (2004). The relationship between lead and crime. *Journal of Health and Social Behavior, 45,* 214-229.

Taylor, M. P., Forbes, M. K., Opeskin, B., Parr, N., & Lanphear, B. P. (2016). The relationship between atmospheric lead emissions and aggressive crime: An ecological study. *Environmental Health: A Global Access Science Source, 15,* 1-10.

Wasserman, G. A., Staghezza-Jaramillo, B., Shrout, P., Popovac, D., & Graziano, J. (1998). The effect of lead exposure on behavior problems in preschool children. *American Journal of Public Health, 88*(3), 481–486.

Weisskopf, M.G., Hu, H., Mulkern, R. V., White, R., Aro, A., Oliveria, S., & Wright, R. O. (2004). Cognitive deficits and magnetic resonance spectroscopy in adult monozygotic twins with lead poisoning. *Environmental Health Perspectives, 112,* 620-625.

Winter, A.S., & Sampson, R.J. (2017). From lead exposure in early childhood to adolescent health: A Chicago birth cohort. *American Journal of Public Health, 107*(9), 1496-1501.

Wright, J. P., Dietrich, K. N., Ris, M. D., Hornung, R. W., Wessel, S. D., Lanphear, B. P., Rae, M.
N. (2008). Association of prenatal and childhood blood lead concentrations with criminal arrests in early adulthood. *PLoS Medicine, 5*(5), 732-740.

Young, S., Moss, D., Sedgwick, O., Fridman, M., & Hodgkins, P. (2015). A meta-analysis of the prevalence of Attention Deficit Hyperactivity Disorder in incarcerated populations. *Psychological Medicine, 45*(2), 247-258.

Young, S., & Thome, J. (2011). ADHD and offenders. *World Journal of Biological Psychiatry, 12*, 124-128.

Young, S., Wells, J., & Gudjonsson, G. (2011). Predictors of offending among prisoners: The role of Attention-Deficit Hyperactivity Disorder and substance use. *Journal Of Psychopharmacology, 25*(11), 1524-1532.