

Prenatal Substance Exposure and Human Development

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Robert was small and slightly underweight at birth. He had been exposed to drugs while his mother was pregnant. His cries sometimes sounded high-pitched, and he was often tense and rigid. Robert's mother moved twice before he was two-years old. First she moved in with her mother; then she moved out again. Robert was not quite as quick as other children at learning new words. He was not good at sorting blocks and learning to pick up beads. Robert had a new sister, a half-sister when he was three. There were not many books or magazines at home. When Robert began kindergarten, he had trouble learning the letters. Sometimes, he seemed a little tuned out and apathetic.

A constellation of prenatal insults, neighborhood poverty, and family disorganization contributed to Robert's delayed developmental course. But what about Robert's mother's substance abuse? Many drugs used during pregnancy travel freely through the umbilical cord and cross the fetal blood-brain barrier. What kind of effect would such drugs have on Robert's development? A developmental systems model suggests that the interplay of many factors influence Robert's development.

The impact of drugs on the fetus during the pregnancy depends on the timing of use, dosage, level of prenatal nutrition, and individual differences among mothers, some of which may be heritable. The impact of maternal drug abuse on subsequent child development is even more complex and multidetermined. It is part of an ongoing array of familial, cultural, and social institutional processes within which the child is nested and in which the growing child participates. Nevertheless, exposure to specific drugs is associated with different types of developmental problems. What drugs was Robert exposed to?

In our society, prenatal drug exposure is a major public health problem. Robert was prenatally exposed to nicotine from the cigarettes his mother smoked during the pregnancy and exposed to alcohol from her drinking. Prenatal exposure to alcohol affects one in four births, with one in twelve mothers reporting binge drinking during the pregnancy. In America, alcohol and tobacco are the most common drugs of abuse during pregnancy.

Alcohol impacts prenatal development by impairing and altering the development of fetal brain structures. Extensive alcohol use during pregnancy is associated with the altered facial characteristics, reduced growth, and severe cognitive deficits of Fetal Alcohol Syndrome. Alcohol effects are dose-dependent. This means there are readily apparent relationships between the quantity of alcohol consumed by the mother and subsequent deficits and problems in the child. Less obvious effects of alcohol exposure include reductions in general intelligence and verbal learning as well as problems with social functioning. Attention problems, memory deficits, and motor skills problems have been associated with habitual social drinking by the expectant mother throughout the pregnancy.

It is not known if there is a minimum safe quantity of alcohol that may be consumed during pregnancy, nor is it known whether cultural factors, such as attitudes toward drinking, impact the association between alcohol use and developmental difficulties. In the United States, alcohol use and tobacco use during pregnancy are associated. One in five women reports using tobacco while pregnant. The association between smoking during pregnancy and adverse child outcomes is well known. Prenatal exposure to cigarettes is associated with premature birth, low birth weight, and irritability in the newborn. Tobacco exposure is associated with lower intelligence scores and higher risk for attention deficit disorder in school age children.

But what about illegal drugs? Did they affect Robert? Approximately 3% of pregnant women report using illicit drugs during their pregnancies, though actual numbers are likely greater. A developmental systems perspective suggests we attend to the social context of drug use and abuse. Illicit drug use is higher among nonwhite than white women, higher among women who have not finished high school, and higher among poorer women. Women who use illicit drugs during a pregnancy are much more likely to smoke and drink during the pregnancy than women who do not use illicit drugs. This is referred to as polydrug use. Because of polydrug use, it is difficult to isolate the impact of specific illicit drugs on the developing child.

Cocaine accounts for 10% of illicit drug use, affecting about 45,000 births per year. Prenatal cocaine exposure has subtle effects on infant and child development. Robert's mother used crack cocaine while she was pregnant. Crack is a smokable form of cocaine and is highly addictive. Initially, crack was thought to do irreparable harm to the fetus. Crack was thought to lead to insurmountable problems in behavior and in cognitive development which would make exposed children unteachable. However, scientifically rigorous research found that cocaine effects were subtle.

Cocaine exposed infants are born slightly earlier and lighter than non-exposed infants. Some of these cocaine exposed babies show slightly elevated levels of irritability at birth – but the majority do not. In the first months of life, cocaine-exposed infants sometimes show signs of emotional under-arousal and negativity. But in most cases there is nothing to distinguish these infants from other infants in their communities. We still do not know if there are subtle deficiencies in the cognitive performance of cocaine exposed infants. But we do know that in an entire population even subtle effects can increase the proportion of children who need later special education services in school.

Both legal and illegal drugs contributed to Robert's apathy, problems in school, and difficulty with learning. Does that mean there are no differences between legal and illegal drugs? Drug molecules are chemical structures. Bonds between atoms in the chemical structure of the molecule determine the physiological properties of a drug. The chemical structure of a drug does not determine its legality.

The issue of dosage underscores the difference between legality and developmental impact. Both cocaine and the nicotine contained in cigarettes are stimulants. There are similarities in how the two drugs impact the fetus. Both cigarette use and cocaine use during pregnancy are associated with low infant birth weight and premature birth. But consider the differences in typical usage of these drugs. Cocaine use is considered high when it occurs three times a week or more. Smoking cigarettes three times a week, on the other hand, might be considered low usage. Cigarette use often occurs multiple times daily, increasing the developing fetus' exposure to the nicotine and other toxic substances contained in cigarette smoke. Issues of dosage have been a focus of the behavioral teratology perspective on prenatal drug exposure.

A behavioral teratology perspective has dominated research into the effects of prenatal drug exposure on development. This perspective posits a linear model of the relationship between exposure and outcome. The behavioral teratology perspective searches for associations between exposure to particular substance and a specific behavioral outcome at a given age. The perspective asks what levels of exposure are safe and what levels affect outcome. The perspective has asked what level of exposure to various substances (from lead to PCBs to alcohol) can impact the developing child and to what degree. However, the behavioral teratology perspective does not focus on the impact of social risk factors such as poverty and family instability on child development. Robert must cope not only with prenatal drug exposure but with the corollaries of poverty and exposure - potato chips and pop for lunch, roaches in the apartment, second hand cigarette smoke in the air, and frequent moves between none-too-pleased relatives and friends.

A developmental systems model is emerging in studies of prenatal drug exposure in children. The developmental model incorporates indices of social risk and family environment into the study of prenatal drug exposure. Current investigations of prenatal drug use from all perspectives focus on infants of mothers who are as similar as possible. They differ - insofar as is possible - primarily with respect to drug use during pregnancy. These infants and mothers are frequently from inner-city neighborhoods and are typically poor and poorly educated. A high proportion are from ethnic minority groups. The good news is that infants who are cocaine exposed show only subtle deficits compared to infants who are not exposed. But this finding is overshadowed by the bad news.

The bad news is that on standardized tests of early development and later tests of cognition, both exposed and non-exposed groups perform poorly. All the children in these samples perform below age norms, placing them at substantial risk for difficulties in school. Whether or not children such as Robert are drug-exposed, poverty and poor parental education place them at risk for deficits in verbal development, difficulties with abstract thinking, and subsequent problems in school.

The developmental systems model seeks to understand how prenatal and social factors interact. Prenatal drug exposure tends to occur among impoverished families. This presents children like Robert with a double whammy. Subtle effects of drug exposure might have negligible impact in environments of optimal stimulation, safety, and educational resources. But the impact of prenatal exposure may be especially detrimental in situations in which mothers are less attentive to their child's cues and provide them with fewer resources for cognitive stimulation. One common problem for children whose parents have low levels of formal education is a deficit in the quantity and complexity of the parental language they hear.

Different aspects of Robert's developmental history are likely to influence his development in different ways at different times. The developmental systems model seeks to understand how prenatal and social factors impact children to different degrees and at different ways at different points in development. The impact of poverty on cognitive development may become more pronounced as children spend more time in an impoverished environment, while the impact of being born underweight declines in importance as children catch up with their peers mentally as well as physically. Little is known about the impact of prenatal cocaine exposure on older children, but subtle deficiencies associated with cocaine exposure may also grow larger as children encounter difficulties with more complex work in school.

The practical implications of the continuous mutual influence between infant and mother are especially salient in the case of prenatal drug exposure. On the one hand, maternal actions cause prenatal drug exposure. On the other hand, the pregnancy itself is often a primary and effective motivation for women to stop or cut down on drug usage. After birth, infant behaviors and predispositions continuously impact mother and family. A slightly premature and perhaps more irritable infant places more emotional demands on its parents. A less sensitive and less involved mother, places increased demands for self-regulation on the infant.

The developmental systems model can also consider real-time social processes and their impact on development. During face-to-face interactions, both cocaine exposed infants and their mothers show tendencies toward disengagement. It may or may not be meaningful to ask whether infant or mother brought such tendencies to the interaction. The important point is such tendencies are likely to be mutually reinforcing, creating a developing infant-mother pair with real, continuing, and perhaps growing difficulties.

What Can Be Done?

In asking what can be done, we must consider the social reality of drug abuse. The social consequences of drug abuse by a pregnant woman vary from state to state. In some states, drug abuse during the pregnancy is regarded, ipso facto, as child abuse and, so, as grounds for criminal prosecution. In other states, civil action by the state can be initiated based solely on the presence of drugs in fetal urine. But it is simplistic to argue that prenatal drug exposure determines the infant's developmental outcome.

Prenatal drug exposure appears to be linked to a range of outcomes. An infant may be unaffected. An infant may experience subtle effects that do or do not increase with development. Alternatively, an infant may be clearly damaged. Only assessment of the infant can determine the

degree of impact. Only assessment of the infant and his or her family can determine the need for referrals for drug rehabilitation and intervention. How should we confront the issue of crack babies? We should remember: It's not the crack – it's the baby!

Fortunately, there may be increasing awareness that drug exposure by itself is not sufficient grounds for termination of parental rights. A developmental systems perspective considers the infant's drug-using mother as part of the system. Illegal drug use is associated with psychiatric problems and childhood histories that often involve physical and sexual abuse. Drug abuse exists and is maintained within interlocking familial, cultural, and social matrices involving poverty, discrimination, and familial instability. Its effects may be lessened by the impact of religious and other community affiliations.

Addiction may be viewed as a social and neurophysiological black hole in the landscape of life. This black hole is known as a an attractor in dynamic systems theory. Once the user becomes addicted and metaphorically enters in orbit around the black hole, it is very hard to escape its pull. Like contact with a black hole, addiction is frequently devastating. Crack, for example, is well known for its ability to destroy lives. As drug user's are drawn near the black hold of addiction, they are increasingly under the sway of the drug. Their lives are consumed by activities to obtain the drug. They neglect social obligations and their role as parents is distorted. Infants are frequently left in under-stimulating environments, are often neglected, and are sometimes exposed to the violence that often accompanies hard-core drug use.

Nevertheless, drug use during pregnancy should not be criminalized. Criminalization takes a complex system, assigns a causal role to the abuser, and seeks punishment. Criminalization represents a dichotomous (right vs. wrong) orientation, which does not help make things right for children. Ten states consider substance abuse or prenatal infant exposure to be forms of child abuse. The women prosecuted under these statutes are typically poor and black. These prosecutions typically do *not* lead to convictions. Criminalization drives pregnant women from the health care system. They are wary of mandatory reporting and the possibility of losing custody for their child. Criminalization leads to inadequate prenatal care and the possibility of accompanying nutritional and health problems for the mother and developing fetus.

Drug use during pregnancy is a question of public health. Maternal drug use and addiction should be recognized as an illness. Like alcoholism, addiction to illicit drugs is characterized by a syndrome of behaviors. A systems perspective suggests that changing these behaviors requires comprehensive treatment at the biological, behavioral, and social levels. Here the idea of the dynamic attractor (the black hole) is useful. Even when out of the immediate vicinity of the pull of addiction, contact with objects, places, and people associated with prior drug use is like re-entering the gravitational pull of the drug. The addict can be quickly drawn in once again. The gravitational well of addiction exerts its influence even when the user is in remission and is not using. Drug addiction is a chronic illness with rates of relapse similar to those of other chronic illnesses. Recognizing addiction as an illness does *not* remove responsibility from the mother. It simply confronts the severity of addiction with insistence that the addiction be treated. A substantial number of states are now providing for or even mandating treatment programs or coordination of services for drug using mothers.

A developmental systems perspective indicates we be aware of infant, mother, and community simultaneously. These forces can facilitate drug use, but they can also facilitate recovery. Maternal mental illness, for example, is often associated with drug abuse. Treating either the mental illness or the drug abuse - without treating both - may offer little benefit.. Systems perspectives emphasize the mutual interconnectedness of infant and mother. Intervention with one partner – particularly the mother – is likely to have multiple cascading positive consequences for the infant. The social support available to the mother in her role as non-drug-using mother is particularly important for her prognosis and child outcome. After intervention, mothers are frequently drawn back into social circles that support or enable her drug use. The ability to escape communities wracked by poverty and legal and illegal drug activity is one predictor of positive outcome for both mother and child. The systems perspective suggests that escaping the gravitational pull of drug abuse, can require a radical change or perturbation in the system.

Sometimes parental rights of drug abusing mothers must be terminated to protect the child. This is a last-ditch measure taken when the current and future safety of the child is clearly at-risk. The Adoption and Safe Families Act of 1997 makes the safety of the child the pre-eminent concern of child welfare actions. It aims to make foster care a temporary solution and makes planning for permanent placement an immediate goal of the child welfare system. These changes follow from a scientifically based concern with articulating the importance of secure, permanent relationships to healthy development. Although reunification with a parent is ideal, in cases of abuse and abandonment, adoption by relative caregivers or a non-related family may be in the best interests of the child.

Whatever the final family constellation, early intensive intervention has shown a significant impact in samples of at-risk infant including those prenatally exposed to cocaine and other substances. Such intervention is most effective when it provides a structured routine to children that includes developmentally appropriate activities and the opportunity to develop warm bonds with child-care providers. Provision of a network of social service referrals is also essential to supporting the family unit as they negotiate obtaining needed services. Obtaining multiple services for family members integrates a developmental systems perspective with common sense. Transportation to a single location that offers both child-centered intervention and, as necessary, referrals to the parent for substance abuse treatment, mental health services, financial assistance, and medical care are important elements of successful programs.

Suggested Readings

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