PERSPECTIVE

Impact of the environment on neurodevelopmental disorders

Garry Morgan, Ian Anderson

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ABSTRACT

Psychopathology develops at different stages of development as a result of complex interactions between nature and nurture, and it can affect each person differently throughout infancy and influence adult results. Mental and physical health is inextricably linked, and cultural, societal, and economic variables all play a role. Anxiety, disruptive behaviour disorders, attention deficit hyperactivity disorder, and depression are the most common mental disorders among children and adolescents over the world, accounting for 13.4% of all cases. Neurodevelopment begins in the womb and continues throughout adulthood, with genetic differences, environmental exposure, and developmental timing all working in concert and in concert. Early life events have been related to a disruption of the neuroendocrine-immune circuitry, resulting in brain changes during vulnerable times. In addition, the environment may cause changes in the structure and function of the organs through altering the epigenome of the developing cell. Due to several risk factors such as poverty, hunger, and dangerous home situations, nearly 200 million children under the age of five are not reaching their developmental potential.

Key word: *Child development; Psychiatric disorder; Mental health; Neurodevelopmental disorders; Environment*

INTRODUCTION

There is no health without mental health, according to the World Health Organization (WHO). Mental health is an important aspect of overall health and happiness. Psychopathology, on the other hand, appears at various developmental stages and as a result of complicated interplay between nature and nurture, and it can affect each person differently throughout infancy and decide adult consequences [1].

According to a meta-analysis of 41 studies conducted between 1985 and 2012, the worldwide prevalence of psychiatric disorders in children and adolescents was 13.4%, with anxiety disorders (6.5%), disruptive behaviour disorders (5.7%), Attention Deficit Hyperactivity Disorder (ADHD) (3.4%), and depressive disorder (3.4%) being the most common disorders (2.6%). These figures rise even further when the authors consider the incidence of children who do not meet all of the diagnostic criteria for a condition but have clinical symptoms, which is estimated to be as high as 26% of all children.

Psychiatric diseases are sometimes known as mental, behavioural, and/or neurodevelopmental disorders (MBDDs), and they are highly common, according to several research. The majority of them begin early in life. In the United States, for example, a nationally representative research found that 17.4% of children aged 2–8 years received a mental diagnosis. The greatest meta-analysis of the age of onset of psychiatric diseases indicated that one-third of people experience their first mental problem before the age of 14, with Autism Spectrum Disorder (ASD) appearing in infancy and ADHD appearing in the preschool years [2,3]. Anxiety disorders, on the other hand, begin in childhood and peak in early adolescence, with separation anxiety arising first, followed by generalised anxiety.

A recent study in Brazil looked at a representative sample of 4 to 5-year-old children in Embu das Artes, So Paulo, and discovered that at least 25% of the preschoolers had mental symptoms. When compared to children without these illnesses, children with mental, behavioural, and/or neurodevelopmental disorders (MBDD) in this group had higher parental stress, parental psychopathology (i.e. anxiety and/or depression), and worse social capital [4].

Many studies have also found that prevalence rates differed depending on the children's social and environmental circumstances. For example, estimates of mental, behavioural, and/or neurodevelopmental impairments ranged from 13.9 percent among the richest children to 22.1 percent among the poorest children. Having a parent with a psychiatric disorder; parents with financial and/or employment problems; lack of access to health services; lack of family/and/or neighbourhood support; and living in a

Editorial Office, Neurodevelopmental Disorders and Treatment, Windsor, Berkshire, England

Correspondence: Gary Morgan, Editorial Office, Neurodevelopmental Disorders and Treatment, Windsor, Berkshire, England, e-mail neurodev.treat@gmail.com

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neighbourhood with limited social resources (such as sidewalks, parks, community centres, or libraries) were all factors that increased the prevalence rates.

Decades of epidemiological, clinical, developmental, and basic research investigations have shown that the environment has a significant impact on all persons' physical, cognitive, social, and emotional development, as well as mental health, throughout their lives. Advances in understanding environmental risk and protective variables for mental health have resulted in a fundamental paradigm change, transforming the old nature-nurture debate into a nonlinear, multisystemic, dialectic model, in which nature and nurture mutually contribute [5].

The major goal of this paper was to review and summarise the key results from the literature on the impact of the environment on neurodevelopmental problems in children.

According to the World Health Organization, nearly 200 million children under the age of five are not reaching their full developmental potential as a result of several risk factors such as poverty, malnutrition, and dangerous home situations.

The prenatal environment may cause changes in the structure and function of the organs by altering the epigenome of the developing cell. Poor foetal growth, for example, is a key indicator of an unfavourable intrauterine environment and has been linked to an increased risk of developmental delays and/or psychiatric illnesses. Fetal growth can be influenced by maternal factors such as the mother's age, socioeconomic level, physical and mental health, and substance addiction [6].

Prematurity is a traumatic experience that leads to impaired socioemotional development. Changes in synaptic efficacy, loss of volume, enlarged ventricles, and alterations in myelination can occur in the premature brain.11 The effects of prematurity can be seen in all gestational age subgroups, but a meta-analysis found that extremely low birth weight children have a stronger association with inattention, hyperactivity, and internalising problems in childhood and adolescence, as well as higher rates of social problems. In an epidemiological sample of an urban setting in Brazil, premature children have higher rates of emotional and behavioural problems at school entry, and even preschoolers with a history of prematurity had a twice higher chance of being above international cutoffs in a social-emotional screening instrument (the Ages and Stages Questionnaire–Social Emotional).

Intrauterine exposure to substance misuse, smoking, mother psychological stress, and/or parental psychiatric illnesses during pregnancy may have long-term consequences, not just during pregnancy. Intrauterine substance misuse or smoke exposure, for example, can modify gene expression of foetal brain regulatory genes involved in brain growth, myelination, and neuronal migration, resulting in changes in brain structure and function. Smoking during pregnancy has been linked to an increased risk of bipolar illness, ADHD, depression, and addiction later in life [7].

Neurodevelopment starts in the womb and continues all the way to maturity. The brain is the major stress and adaptation organ, interpreting and regulating behavioural, neuroendocrine, autonomic, and immunological reactions to events (adverse or protective), and altering physically and functionally in response to significant adversity or favourable experiences [8]. All future developmental processes will be built on the foundation of the interconnectedness between these experiences and individual responses to them during the first years of life.

The brain in early life is incredibly malleable, but this plasticity also makes it more vulnerable to all kinds of experiences. The nature and timing of these events have a variety of effects on the development of the brain, particularly if they occur during "sensitive or essential periods." The crucial periods are a brief and well-defined window of opportunity during which environmental input induces irreversible changes in brain function and structure.

There are cascades of these sensitive periods for specific complicated developmental domains during early childhood. Understanding how the timing of environmental events may enhance the risk of abnormal development requires identifying these times.

The consequences of adverse events on rats and nonhuman primates have been shown to target brain areas involved in physiological stress and behaviour, such as the amygdala, prefrontal cortex, and hippocampus. Understanding the two different contexts in which neuroplasticity develops is critical to better understanding how the type and timing of environmental experiences alter the brain: Expectant of early stimulating experiences: the brain has evolved to "anticipate" some early stimulating experiences and uses them to influence neural responses. Healthy infants, for example, require visual input to develop their visual system, and those who do not receive it acquire permanent blindness (i.e., infants with congenital cataracts [9].

Exposure to different events can result in different developmental outcomes, according to this notion of neuroplasticity. Newborns whose moms with post-partum depression, for example, have more difficulties detecting emotional expressions than infants whose mothers are not sad, possibly because depressive mothers present a lesser variety of diverse facial emotions.

Infants were withdrawn from their mothers at a young age and nurtured in solitude or with peers in a series of research with nonhuman primates. When these animals were adults, they showed signs of depression and motor stereotypies, were agitated, impulsive, and had aberrant stress reactions. Animals raised with peers, on the other hand, seemed to reverse many of the deleterious effects of early maternal separation.

The authors summarise three possible ways in which the powerful and complicated interplay between genes and the environment can occur below.

- Gene-environment correlations: in this situation, genes that determine a trait also influence environmental risk exposure. A woman with high anxiety levels, for example, will exhibit anxious behaviours at home, which will eventually influence the child.
- Genotype–environment interactions: When a person's genotype influences their response to environmental circumstances, this is called a genotype–environment interaction. Individuals with a "sensitive" gene polymorphism will be at a higher risk than those with a "insensitive" gene polymorphism if they are exposed to a predisposing environment. Individuals having at least one copy of the short allele of the promoter region of the serotonin transporter (5-HTT) gene polymorphism were more likely to be diagnosed with depression than those with too long alleles. Furthermore, children (aged 52 months) with a short 5-HTT allele and poor responsive care from their mothers were less competent in academic

skills, school involvement, and social functioning with peers than children with more responsive care from their mothers.

- Epigenetic gene-regulatory processes: early life events can alter the function of chromatin, altering gene expression. DNA methylation, which acts as a molecular memory of each individual's environment, is one method for this to happen. For example, mother smoking during pregnancy promotes disparities in DNA methylation at birth, with effects that can last a lifetime and potentially have transgenerational consequences.

Focus on the research of resilience and risk factors, taking into account that genetic differences, environmental exposure, and developmental timing operate synergistically and contingently. Good health is the outcome of interactions between key protective and risk factors at essential or sensitive developmental stages in this context.

A healthy neurodevelopmental pathway exists when protective and risk variables are in balance. On the contrary, when these neurodevelopmental pathways are delayed or diverged, a person is significantly more likely to have a

Early-onset neurodevelopmental abnormalities are more severe, especially if they are not recognised and treated early. As a result, screening techniques and early interventions may allow for more effective healthcare, education, and social pathways by intervening before health problems worsen or develop, minimising developmental disparities, and taking action before health problems worsen or develop. It's also critical that early childhood programmes include methods for reducing socioeconomic inequality [9]. These initiatives can result in better levels of human capital and social mobility, as well as economic benefits, because the return on investment in early childhood is significantly larger than the return on investment later in life.

CONCLUSION

The importance of childhood experiences on lifelong health is supported by a large body of evidence. These events take place in a variety of systems influenced by risk and protective factors such as cultural, social, and economic considerations, ethnic identity, and parental and social support. Because they have enough social conditions to thrive, all parents are capable of encouraging their children's integral development. It's critical to note that maintaining support for the creation of a protective environment that includes effective parent-child contact is critical to limiting the consequences of neurodevelopmental problems during early life.

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