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ANALYSING THE PUBLIC HEALTH RELATIONSHIPS BETWEEN ENVIRONMENTAL FACTORS AND NEURODEVELOPMENTAL DISORDERS

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Abstract

Several studies have shown that environmental factors play a significant role in the pathophysiology of neurodevelopmental disorders, including autism spectrum disorder (ASD). Social interaction deficit, cognitive impairment, intellectual problems, and repetitive and stereotyped behavioural patterns are a few of the manifestations of ASD, a neurodevelopmental disorder that reduces the quality of life of individuals who are afflicted with it. Environmental and genetic variables influencing developmental physiological processes have been implicated in the pathophysiology of ASD. In this review, we discuss studies of the interface between the environment and neurodevelopmental disorders and the mechanism by which environmental toxins can impact neurodevelopment. Moreover, reports identifying neurotoxic metals—more particularly, lead, mercury, cadmium, nickel, and manganese—as environmental risk factors in the aetiology of ASD are covered under this review. Based on this study, improving the environment could be crucial in controlling ASD.

Keywords: autism, neurodevelopmental disorders, neurotoxicity, metals, environment, public health

1. INTRODUCTION

For many years, there has been evidence linking early-life psychosocial risk to adverse neurodevelopmental outcomes.Simultaneously, the body of research describing how environmental toxins affect neurobiology and health consequences has expanded significantly in recent years [16]. Starvation have been demonstrated by both extensive epidemiologic research and animal models [1]. Accordingly, recent studies have shown that a variety of exposures are likely to influence how the central nervous system develops in terms of both structure and function [11]. This could result in a common pathway that could translate various risk factors into cognitive [12]. New pathways of discovery can be opened by taking a wide view of the developmental environment, which includes looking at environmental toxicants, malnutrition, and psychosocial adversity in studies that are in dialogue with one another [2]. This research can show possible cross-exposure interactions or common pathways that increase the risk of neurodevelopmental disorders across exposures. Emphasizing the necessity of addressing environmental justice issues more generally than only those pertaining to the chemical environment [9] [10].

A recurring subject in this research is the influence of the environment, in its widest sense, on the growth of the central nervous system. Identifying the clustering of risk across the chemical and social environment, observing final common pathways impacted by multiple forms of environmental exposure [3]. The main objectives of this works are

1. To analyze the socioeconomic and demographic factors that influence exposure to environmental toxins and the risk of neurodevelopmental disorders [17].

2. To evaluate the effectiveness of existing public health policies and interventions aimed at reducing exposure to environmental toxins and preventing neurodevelopmental disorders [14].

2. MATERIALS AND METHODS

Because of the large number of greenhouses in the area, Almeria has become well-known throughout the world for its studies on occupational and environmental pesticide exposure. Consequently, a variety of insecticides are employed [18]. Insecticides and fungicides have been identified as the most commonly utilized chemicals in greenhouses in this region, per earlier research on the subject [4].

Study Population

Over the course of 11 years (2011–2022), a thorough study was carried out on children who were referred to the Territorial Delegation of Health and Families' Early Intervention Centers in the Almeria region [13]. This study examined the following variables: diagnosis, health district, age at referral, and sex. The diagnosis included in the ODAT categorization comprised the remaining variables. The data had already been anonymised. In order to reduce the chance of error, pediatric experts who were a member of the Early Care program always made the diagnosis using protocolized criteria. This study complied with the Declaration of Helsinki for International Public Health Research and was authorized by the University of Almeria's Research Ethics Committee [15].

Statistical Analysis

In this study, percentages and frequencies were used to analyze categorical variables. Measures of dispersion (standard deviations) and central tendency (mean) were used to analyze quantitative variables. Furthermore, a bivariate statistical analysis was conducted using the Mann–Whitney U and Kruskal–Wallis tests to compare quantitative variables following the completion of the Kolmogorov–Smirnov normality tests. Using Pearson's chi-square test, differences in diagnostic or sociodemographic characteristics by exposure area were evaluated. Multiple binary logistic regression was used to calculate the risk of learning disability after adjusting for age at referral, sex, and health district. Due to their potential to affect the statistical model, these variables were taken into account [5].

2. Autism spectrum disorder as a neurodevelopmental disorder

The term "neurodevelopmental disorder" (NDD) refers to a broad category of disorders caused by abnormal brain development. The primary cause of this aberrant neurodevelopment is the exposure of the fetus to toxic chemicals. Deficits in behavior, cognition, communication, and occasionally motor abilities are among its symptoms. This group includes neurodevelopmental disorders like attention deficit/hyperactivity disorder (ADHD), intellectual disability, and autism spectrum disorder (ASD).

Table1: Rotated Component Matrix of variable forming Expected Level of ServiceQuality

Rotated Component Matrix	Tangibles			Reliability
	Physical Environment	Credibility	Security	Reliability
	1	4	9	2
What are the policy and public health implications of the relationships between environmental factors and NDDs, and how can environmental interventions be used to prevent NDDs?	0.761			
How do environmental factors impact the risk of NDDs in offspring of mothers who experienced trauma or stress during pregnancy?	0.700			
Can environmental factors, such as exposure to music or art, have a positive impact on neurodevelopmental outcomes and reduce the risk of NDDs?	0.637			

What is the relationship between environmental factors and the gut-brain axis in NDDs, and how can modulating the gut microbiome impact NDD symptoms?	0.606			
How do environmental factors impact neurodevelopmental outcomes in offspring of mothers with pre-existing medical conditions, such as diabetes or hypertension?	0.462			
Can machine learning and data analytics be used to identify complex relationships between environmental factors and NDDs, and to predict NDD risk at the individual level?	0.441			
How do environmental justice and socioeconomic factors impact exposure to environmental toxins and the risk of NDDs in vulnerable populations?				0.795
Can environmental interventions, such as reducing exposure to endocrine-disrupting chemicals (EDCs), improve neurodevelopmental outcomes and reduce the risk of NDDs?				0.671
What is the role of the microbiome in neurodevelopment, and how do environmental factors, such as diet and exposure to antibiotics, impact the microbiome and NDD risk?				0.668
How do environmental factors, such as temperature and humidity, impact the risk of NDDs, and what are the underlying biological mechanisms?				0.488
How do environmental factors impact the risk of NDDs in vulnerable populations, such as low-income or minority communities, and what are the implications for environmental justice and health equity?		0.797		
Can environmentally factors, such as exposure to nature or outdoor activities, improve cognitive and behavioral outcomes in individuals with NDDs?		0.394		
How do environmental factors, such as access to green spaces and outdoor activities, impact mental health and well-being in children and adolescents?			0.797	

3. Environmental impact on neurodevelopmental disorders

It has been shown that a young person's surroundings have a significant impact on their health and is more likely to interfere with their neurodevelopment.

Table 2: Rotated Component Matrix of variable forming Expected Level of Service Quality

Rotated Component Matrix[a]	**Responsiveness**	**Assurance**			**Empathy**	
	Responsiveness	Competence	Access	Commucation	Courtesy	Understanding
	3	5	6	10	7	8
What are the policy and public health	0.729					

implications of the relationships between environmental factors and NDDs, and how can environmental interventions be used to prevent NDDs?						
How do environmental factors impact the risk of NDDs in offspring of mothers who experienced trauma or stress during pregnancy?	0.660					
Can environmental factors, such as exposure to music or art, have a positive impact on neurodevelopmental outcomes and reduce the risk of NDDs?	0.536					
What is the relationship between environmental factors and the gut-brain axis in NDDs, and how can modulating the gut microbiome impact NDD symptoms?	0.422					
What are the epigenetic mechanisms underlying the relationship between environmental factors and NDDs, and how can epigenetic markers be used to predict NDD risk?		0.738				
How do environmental justice and socioeconomic factors impact exposure to environmental toxins and the risk of NDDs in vulnerable populations?		0.726				
Can environmental interventions, such as reducing exposure to endocrine-disrupting chemicals (EDCs), improve neurodevelopmental outcomes and reduce the risk of NDDs?		0.498				
What is the role of the microbiome in neurodevelopment, and how do environmental factors, such as diet and exposure to antibiotics, impact the microbiome and NDD risk?			0.706			
How do environmental factors, such as temperature and humidity, impact the risk of NDDs, and what are the underlying biological mechanisms?			0.636			
Can exposure to natural environments, such as green spaces and parks, mitigate the risk of NDDs and improve neurodevelopmental outcomes?					0.753	
How do prenatal and early childhood exposures to air pollution, pesticides, and other environmental toxins impact neurodevelopment and the risk of NDDs?					0.731	
What are the key environmental factors associated with an increased risk of neurodevelopmental disorders (NDDs), such as autism spectrum disorder (ASD) and attention deficit hyperactivity						0.738

disorder (ADHD)?						
How do environmental factors impact the risk of NDDs in vulnerable populations, such as low-income or minority communities, and what are the implications for environmental justice and health equity?						0.672
How do environmental factors, such as access to green spaces and outdoor activities, impact mental health and well-being in children and adolescents?				0.732		
Can environmental interventions, such as reducing exposure to endocrine-disrupting chemicals, improve cognitive and behavioral outcomes in individuals with neurodevelopmental disorders?				0.484		

When taken as a whole, these studies show that we cannot have a limited perspective on intellectual and developmental disorders.The work presented here demonstrates both the individual IDDRCs' capabilities and the network's overall strength in combining various levels of analysis and specializations, which are characteristics of these inter-disciplinary centres.

4. CONCLUSION

The current study's findings appear to suggest that exposure may have an effect on children's neurodevelopment and learning difficulties in regions and widespread pesticide use. The most common prenatal diagnosis was chromosomal abnormalities; the most common perinatal diagnosis was brain injury; and the most common postnatal. Age-related declines in the likelihood of neurodevelopmental disorders were likely caused by early detection. In terms of gender, male children were shown to have a higher incidence of neurodevelopmental problems, which could be because of genetic predisposition. Thus, this study emphasizes how crucial it is to carefully evaluate the possible neurotoxicity of specific compounds, such pesticides.

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